

***Remedial Investigation/Feasibility Study  
Final Work Plan***

***Waukegan Manufactured Gas  
and Coke Plant Site  
Waukegan, Illinois***

***Prepared for North Shore Gas Company***

***Under the Administrative Order on Consent Re: Remedial Investigation and  
Feasibility Study for the Waukegan Manufactured Gas and Coke Plant Site  
Waukegan, Illinois***

***October 24, 1991***

***Barr***  
*Engineering Company*

# **Barr**

*Engineering Company*

8300 Norman Center Drive  
Minneapolis, MN 55437-1026  
Phone: (612) 832-2600  
Fax: (612) 835-0186

December 16, 1991

Ms. Cindy J. Nolan, HSRL-6J  
U.S. Environmental Protection Agency  
77 West Jackson Boulevard  
Chicago, IL 60604

Re: Waukegan Manufactured Gas and Coke Plant Site  
Modifications/Additions to Phase I Investigation Procedures

Dear Ms. Nolan:

The schedule for implementing field investigations at the above-referenced site is outlined in the October 24, 1991 Final Work Plan. Based on the November 21, 1991 receipt of your letter approving the work plan, Phase I field work is scheduled to begin the week of January 13, 1992. A site visit during the week of January 6, 1992 will be necessary to mark sampling locations and set up the field office. Implementation of this schedule will depend on timely resolution of site access issues and on receiving final approval of the Quality Assurance Project Plan prior to the commencement of on-site activities on January 6, 1992.

The Final Work Plan and associated documents detailed sampling methods for the Phase I investigation. In the case of sampling to be done with a hand auger, implementation will be difficult for Phase I activities performed during the winter. For other proposed procedures, additional details regarding methods have been determined since preparation of the final work plan. The following modifications/additions to the planned procedures are proposed to allow effective winter implementation of the work plan:

- Due to difficulties anticipated for hand augering in frozen soils, all background soil samples (Subtask I.3) and surficial soil samples (Subtask I.4) will be collected using hollow-stem auger drilling equipment and split-spoon samplers.
- Because surficial soil samples will be collected using split-spoon sampling equipment rather than hand augers, more detailed soil characterization information will be available for each sampling location. Therefore, the auxiliary test trenches designed to provide supplementary soil characterization information will not be placed.
- All soil samples for analysis of volatile organic compounds will be collected in a single brass liner held against the shoe end of the split-spoon sampler by a bead or ring on the inner radius of the sampler.

- As described in the Field Sampling Plan, decontamination procedures may involve the use of solvents to remove coal tar from sampling equipment. A methanol or hexane rinse, followed by air drying and steam cleaning, will be used to clean equipment if steam cleaning and detergent do not remove all visible contamination. If a solvent rinse is used to clean drilling equipment, these procedures will be performed over a nonleaking mud tank, cattle trough, or other similar basin. Rinsate will be collected and containerized.

I will call you this week to confirm your approval of these modifications/ additions prior to their implementation. In the interim, please call Jim Langseth or me if you have any questions.

Sincerely,

Michael M. Relf

MMR:crs

c: Pat Doyle

Russ Selman

13\49\003\WCPPHI.LTR

***Remedial Investigation/Feasibility Study  
Final Work Plan***

***Waukegan Manufactured Gas  
and Coke Plant Site  
Waukegan, Illinois***

***Prepared for North Shore Gas Company***

***Under the Administrative Order on Consent Re: Remedial Investigation and  
Feasibility Study for the Waukegan Manufactured Gas and Coke Plant Site  
Waukegan, Illinois***

***October 24, 1991***

***Barr***

***Engineering Company***

***8300 Norman Center Drive***

***Minneapolis, MN 55437***

***Phone: (612) 832-2600***

***Fax: (612) 835-0186***

REMEDIAL INVESTIGATION/FEASIBILITY STUDY  
WORK PLAN  
WAUKEGAN MANUFACTURED GAS AND COKE PLANT SITE

TABLE OF CONTENTS

	<u>Page</u>
SECTION 1 INTRODUCTION . . . . .	1-1
1.1 SCOPE OF DOCUMENTS . . . . .	1-1
1.2 OBJECTIVES OF RI/FS . . . . .	1-2
1.3 APPROACH TO RI/FS . . . . .	1-3
SECTION 2 BACKGROUND . . . . .	2-1
2.1 INTRODUCTION . . . . .	2-1
2.2 OWNERSHIP . . . . .	2-1
2.3 SITE OPERATIONS . . . . .	2-2
2.3.1 <u>Wood Treating Plant</u> . . . . .	2-2
2.3.2 <u>Waukegan Coke Plant</u> . . . . .	2-2
2.3.3 <u>OMC Operations</u> . . . . .	2-5
2.3.4 <u>Site Definition</u> . . . . .	2-7
2.4 PREVIOUS INVESTIGATIONS . . . . .	2-7
2.4.1 <u>Waukegan Harbor PCB Studies</u> . . . . .	2-7
2.4.2 <u>1989 New Slip Soil Investigation</u> . . . . .	2-8
2.4.2.1 <u>Soil Boring Installation</u> . . . . .	2-9
2.4.2.2 <u>Monitoring Well Installation</u> . . . . .	2-9
2.4.2.3 <u>Soil Sampling</u> . . . . .	2-9
2.4.2.4 <u>Groundwater Sampling</u> . . . . .	2-10
2.4.3 <u>1990/1991 New Slip Soil Investigation</u> . . . . .	2-10
2.4.4 <u>Illinois EPA Sampling</u> . . . . .	2-11
2.4.5 <u>OMC Test Trenching</u> . . . . .	2-11
SECTION 3 SITE DESCRIPTION . . . . .	3-1
3.1 SITE ENVIRONMENT . . . . .	3-1
3.1.1 <u>Demographic Information</u> . . . . .	3-1
3.1.2 <u>Climate</u> . . . . .	3-1
3.1.3 <u>Site Ecology</u> . . . . .	3-2
3.1.4 <u>Land Use</u> . . . . .	3-3
3.2 REGIONAL HYDROGEOLOGIC SETTING . . . . .	3-4
3.2.1 <u>Unconsolidated Sediments</u> . . . . .	3-4
3.2.2 <u>Bedrock Units</u> . . . . .	3-5
3.3 SITE HYDROGEOLOGIC SETTING . . . . .	3-6
3.3.1 <u>Geology</u> . . . . .	3-6
3.3.2 <u>Groundwater Flow</u> . . . . .	3-7
3.3.2.1 <u>OMC Plant No. 2 Site Hydrogeology</u> . . . . .	3-8
3.3.2.2 <u>WCP Site Hydrogeology</u> . . . . .	3-9
3.3.2.3 <u>Effects of New Slip on Site Groundwater</u> <u>Flow</u> . . . . .	3-9

## TABLE OF CONTENTS (Cont.)

	<u>Page</u>
3.4 WATER QUALITY . . . . .	3-10
3.4.1 <u>Groundwater Quality</u> . . . . .	3-10
3.4.2 <u>Surface Water Quality</u> . . . . .	3-11
3.5 SOIL QUALITY . . . . .	3-11
 SECTION 4 INITIAL EVALUATION . . . . .	 4-1
4.1 INTRODUCTION . . . . .	4-1
4.2 IDENTIFIED CONTAMINATION . . . . .	4-1
4.3 POTENTIAL CHEMICALS OF CONCERN . . . . .	4-2
4.4 PHYSICAL AND CHEMICAL CHARACTERISTICS OF POTENTIAL CONTAMINANTS . . . . .	 4-3
4.4.1 <u>Coal Tar</u> . . . . .	4-3
4.4.2 <u>Creosote</u> . . . . .	4-3
4.4.3 <u>Dissolved Organic Compounds</u> . . . . .	4-4
4.4.3.1 PAH Compounds . . . . .	4-4
4.4.3.2 Volatile Organic Compounds . . . . .	4-4
4.4.3.3 Phenolic Compounds . . . . .	4-4
4.4.4 <u>Inorganic Compounds and Metals</u> . . . . .	4-5
4.4.5 <u>PCB Compounds</u> . . . . .	4-5
4.5 CONCEPTUAL SITE MODEL . . . . .	4-5
4.5.1 <u>Sources</u> . . . . .	4-5
4.5.2 <u>Contaminant Migration</u> . . . . .	4-7
4.5.3 <u>Potential Exposure Pathways</u> . . . . .	4-8
4.5.4 <u>Potentially Exposed Populations</u> . . . . .	4-10
4.6 PRELIMINARY RISK ASSESSMENT AND IDENTIFICATION OF DATA GAPS . . . . .	 4-11
4.6.1 <u>Preliminary Risk Characterization</u> . . . . .	4-11
4.6.2 <u>Identification of Data Gaps</u> . . . . .	4-11
 SECTION 5 DEVELOPMENT OF PRELIMINARY REMEDIAL ACTIONS . . . . .	 5-1
5.1 INTRODUCTION . . . . .	5-1
5.2 REQUIREMENTS FOR REMEDIAL ACTION OBJECTIVES . . . . .	5-1
5.3 PRELIMINARY IDENTIFICATION OF SITE-SPECIFIC REMEDIAL ACTION OBJECTIVES . . . . .	 5-3
5.4 PRELIMINARY IDENTIFICATION OF SITE-SPECIFIC ARARs . . . . .	5-3
5.4.1 <u>Definition of ARARs</u> . . . . .	5-4
5.4.2 <u>Type of ARARs</u> . . . . .	5-5
5.4.3 <u>Process for Identification of Preliminary Site-                 Specific ARARs and Preliminary Remediation Goals</u> . . . . .	 5-6
5.5 INITIAL DEVELOPMENT OF REMEDIAL ALTERNATIVES . . . . .	5-7
5.5.1 <u>Remedial Alternatives for Soils</u> . . . . .	5-8
5.5.1.1 No Action . . . . .	5-8
5.5.1.2 Monitoring and Institutional Controls . . . . .	5-9
5.5.1.3 Containment . . . . .	5-9
5.5.1.4 Biological Treatment . . . . .	5-9
5.5.1.5 In Situ Soil Flushing . . . . .	5-10
5.5.1.6 In Situ Vitrification . . . . .	5-10
5.5.1.7 In Situ Stabilization/Solidification . . . . .	5-10

## TABLE OF CONTENTS (Cont.)

	<u>Page</u>
5.5.1.8 In Situ Vapor Extraction . . . . .	5-11
5.5.1.9 Excavation . . . . .	5-11
5.5.1.10 On-Site Vault . . . . .	5-11
5.5.1.11 Off-Site Disposal . . . . .	5-11
5.5.1.12 Thermal Treatment . . . . .	5-12
5.5.1.13 Soil Washing . . . . .	5-12
5.5.2 <u>Remedial Alternatives for Groundwater Impacts on</u> <u>Surface Waters</u> . . . . .	5-12
5.5.2.1 No Action . . . . .	5-13
5.5.2.2 Monitoring and Institutional Controls . . . . .	5-13
5.5.2.3 Containment . . . . .	5-13
5.5.2.4 In Situ Biological Treatment . . . . .	5-13
5.5.2.5 Groundwater Extraction . . . . .	5-14
5.5.2.6 Groundwater Treatment and Discharge . . . . .	5-14
SECTION 6 SCOPE OF WORK FOR REMEDIAL INVESTIGATION/FEASIBILITY	
STUDY . . . . .	6-1
6.1 DATA QUALITY OBJECTIVES . . . . .	6-2
6.2 SUMMARY OF RI/FS TASKS . . . . .	6-2
6.3 TASK I: FIELD INVESTIGATION - PHASE I . . . . .	6-4
6.3.1 <u>Subtask I.1 Investigation Support</u> . . . . .	6-4
6.3.2 <u>Subtask I.2 Preliminary Source Area</u> <u>Characterization</u> . . . . .	6-5
6.3.3 <u>Subtask I.3 Background Soil Sampling</u> . . . . .	6-8
6.3.4 <u>Subtask I.4 Surficial Soil Sampling</u> . . . . .	6-8
6.3.5 <u>Subtask I.5 Pilot Borings/Monitoring Wells</u> . . . . .	6-9
6.3.5.1 Pilot Borings . . . . .	6-9
6.3.5.2 Monitoring Well/Piezometer Installation . . . . .	6-10
6.3.5.3 Survey . . . . .	6-12
6.3.5.4 Water Level Measurements . . . . .	6-12
6.3.5.5 Permeability Testing . . . . .	6-12
6.3.6 <u>Subtask I.6 Groundwater Sampling</u> . . . . .	6-12
6.3.7 <u>Subtask I.7 Ecological Survey</u> . . . . .	6-12
6.3.8 <u>Subtask I.8 Preparation of Phase I Technical</u> <u>Memorandum</u> . . . . .	6-13
6.4 TASK II: FIELD INVESTIGATION - PHASE II . . . . .	6-14
6.4.1 <u>Subtask II.1: Investigation Support</u> . . . . .	6-15
6.4.2 <u>Subtask II.2: Soils Investigation</u> . . . . .	6-15
6.4.2.1 Soil Borings . . . . .	6-15
6.4.2.2 Soil Sampling . . . . .	6-17
6.4.2.3 Soil Sampling Equipment and Procedures . . . . .	6-21
6.4.3 <u>Subtask II.3 Hydrogeologic Investigation</u> . . . . .	6-21
6.4.3.1 Monitoring Well Installation . . . . .	6-21
6.4.3.2 Survey . . . . .	6-22
6.4.3.3 Water Level Measurements . . . . .	6-22
6.4.3.4 Permeability Testing . . . . .	6-23

## TABLE OF CONTENTS (Cont.)

	<u>Page</u>
6.4.4 <u>Groundwater and Ecological Sampling</u> . . . . .	6-24
6.4.4.1 Groundwater Sampling . . . . .	6-25
6.4.4.2 Ecological Sampling . . . . .	6-25
6.5 TASK III: SAMPLE ANALYSIS/VALIDATION . . . . .	6-26
6.6 TASK IV: DATA EVALUATION . . . . .	6-26
6.7 TASK V: RISK ASSESSMENT . . . . .	6-27
6.8 TASK VI: REMEDIAL INVESTIGATION REPORT . . . . .	6-27
6.9 TASK VII: REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING . . . . .	6-28
6.10 TASK VIII: ALTERNATIVES EVALUATION . . . . .	6-29
6.11 TASK IX: FEASIBILITY STUDY REPORT . . . . .	6-29
6.12 PROJECT MANAGEMENT . . . . .	6-29
6.12.1 <u>Site Management</u> . . . . .	6-29
6.12.2 <u>Data Management</u> . . . . .	6-30
6.12.3 <u>Schedule</u> . . . . .	6-30

## REFERENCES

## TABLES

Table 2.2-1	Title Search Information
Table 2.3-1	Inventory of Structures/Equipment at the WCP Site
Table 4.1-1	Potential Chemicals of Concern, Manufactured Gas Plant Sites
Table 4.4-1	Major Constituents of Coal Tar
Table 4.4-2	Comparison of the Physical Properties of Coal Tar and Creosote
Table 4.4-3	Physical and Chemical Properties of PAH and Volatile Organic Compounds
Table 4.5-1	Potential Exposure Pathways
Table 6.3-1	Phase I RI Sampling Summary
Table 6.3-2	Phase II RI Sampling Summary
Table 6.12-1	Estimated Duration of Project Tasks
Table 6.12-2	Estimated Project Schedule

## FIGURES

Figure 2.1-1	Site Location Map
Figure 2.3-1	Waukegan Manufactured Gas and Coke Plant Site
Figure 2.3-2	Flow Chart, Manufactured Gas/Coke Processes
Figure 2.4-1	Previous Investigations, Soil Boring and Monitoring Well Locations
Figure 4.5-1	Conceptual Site Model, Potential Contaminant Release and Migration
Figure 5.5-1	Identification of Potentially Viable Remedial Technologies and Process Options for Soils
Figure 5.5-2	Identification of Potentially Viable Remedial Technologies and Process Options for Groundwater
Figure 6.3-1	Preliminary Source Area Characterization
Figure 6.3-2	Proposed Background Soil Sampling Locations
Figure 6.3-3	Proposed Surficial Soil Sampling Locations
Figure 6.3-4	Proposed Pilot Boring, Monitoring Well, and Piezometer Locations

## APPENDICES

Appendix A	New Slip Investigations - Groundwater Quality Data
Appendix B	New Slip Investigations - Soil Quality Data
Appendix C	IEPA Investigations - Soil Quality Data

REMEDIAL INVESTIGATION/FEASIBILITY STUDY  
WORK PLAN  
WAUKEGAN MANUFACTURED GAS AND COKE PLANT

SECTION 1  
INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan outlines the investigative approach that is proposed to evaluate the extent of groundwater and soil contamination at the Waukegan Manufactured Gas and Coke Plant (WCP) site and to develop a feasibility study that will evaluate potential remedies for soil and groundwater contamination.

This work plan and supporting documents have been prepared pursuant to Section VIII of the September 27, 1990 Administrative Order on Consent between the United States Environmental Protection Agency (EPA) and the North Shore Gas Company.

1.1 SCOPE OF DOCUMENTS

Section 1 of the work plan includes: a description of the organization of the RI/FS work plan; the relationships between this document, the Sampling and Analysis Plan (SAP) (which consists of the Field Sampling Plan [FSP] and the Quality Assurance Project Plan [QAPP]), and the Health and Safety Plan (HSP); the objectives of the RI/FS; and a summary of the proposed approach to the RI/FS.

Section 2 summarizes the site background, including information on prior ownership, previous operations, and previous investigations. Section 3 gives information on the regional and local hydrogeologic setting and a preliminary assessment of the available data for groundwater, surface water, and soil quality. Section 4 provides an initial evaluation of the site, including previously identified contamination, potential chemicals of concern, physical and chemical characteristics of the chemicals of concern, a description of

the potential migration and exposure pathways, a preliminary risk assessment, and a discussion of mechanisms for the identification of Applicable or Relevant and Appropriate Requirements (ARARs).

Section 5 presents the development of preliminary remedial actions. Section 6 presents the scope of work of the RI work plan, including a brief description of each task and the rationale behind it, and a proposed schedule for implementation of the work plan tasks.

Details of procedures for the RI field activities are described in the FSP portion of the SAP. Quality assurance and quality control procedures for the field and laboratory activities are included in the QAPP portion of the SAP. Plans and procedures for health and safety requirements are in the HSP.

## 1.2 OBJECTIVES OF RI/FS

The objectives of the RI/FS of the WCP site are to:

1. Define the extent and nature of groundwater contamination to the degree necessary to protect human health and the environment.
2. Define the extent and nature of soil contamination to the degree necessary to protect human health and the environment.
3. Identify and characterize source areas.
4. Evaluate potential effects of the site on public health and the environment.
5. Identify alternative response actions.
6. Collect data necessary to: (1) develop and evaluate remedial action alternatives; and (2) select remedial actions.

### 1.3 APPROACH TO RI/FS

The field investigation for the RI is to be conducted in two phases. The major objectives of the first phase are: (1) to provide information on the location, nature, and horizontal extent of potential contaminant source areas; and (2) to provide preliminary information on groundwater flow patterns and groundwater quality. These data will be used to focus soil and groundwater investigations in Phase II. Activities to be conducted during each phase of the RI are outlined below.

Phase I activities include test trenching to assess the horizontal extent of soil contamination from known site operations (i.e., manufactured gas plant, coking plant, and creosoting facility operations) using field screening techniques. Field screening techniques are particularly relevant to investigations of manufactured gas/coking plant and creosoting sites because wastes from such facilities generally discolor and leave a distinctive oily residue in materials they encounter. Representative samples of visually contaminated soils will be analyzed to assess soil quality. In addition, surficial soil samples will be collected from outside the areas of known site operations to assess the possible presence of a broad range of chemical parameters. Soil samples will also be collected from predetermined off-site locations to assess background soil quality.

Piezometers and monitoring wells will be installed during Phase I to provide a preliminary assessment of groundwater flow patterns and to evaluate the quality of groundwater flowing off-site.

An ecological survey will also be performed during the Phase I investigation.

Phase II of the RI will utilize data from Phase I to focus additional soil and groundwater investigations. Soil borings will be placed in areas of identified contamination (based on the test trenching program) to evaluate the vertical extent of soil contamination and confirm the horizontal extent determined from Phase I. Analyses of soil samples will be performed to

quantify levels of contamination and confirm areas identified as uncontaminated. Within each identified area of contaminated soils, interpretations of the extent of vertical contamination will be required for locations where soil borings are not placed. These interpretations will be based on information from soil borings placed in zones of similar shallow contamination (based on Phase I results) within that area.

The locations of monitoring wells placed in Phase II will be selected on the basis of groundwater flow information (including modeling) and contaminant source area identification developed from Phase I information. Data from Phase II wells will be used to refine groundwater flow and quality assessments. The groundwater quality data will also supplement soil boring data for identifying and characterizing source areas.

## SECTION 2

### BACKGROUND

#### 2.1 INTRODUCTION

The Waukegan Manufactured Gas and Coke Plant (WCP) site is located in Waukegan, Illinois, approximately 35 miles north of Chicago. The site is located on a peninsula on the east side of Waukegan Harbor. The site location is shown in Figure 2.1-1. The site's background and history are discussed below. Background information regarding the site was previously summarized in a Technical Memorandum (Barr, 1990).

#### 2.2 OWNERSHIP

A title search conducted for the Outboard Marine Corporation (OMC, 1990) indicates that the WCP site was originally owned by Charles H. Coster. In July of 1893, the land was acquired by the Elgin, Joliet, and Eastern Railway Company (EJ&E). The railroad company owned the land for the next 34 years until it was sold to the William A. Baehr Organization on March 14, 1927. On the same day, the ownership of this site was transferred to the North Shore Coke and Chemical Company. In 1941, the North Shore Gas Company acquired the property and eventually sold it to the Waukegan Coke Organization (not affiliated with North Shore Gas Company) in 1947. In less than a year the plant was sold to General Motors Corporation (GM). GM operated the site to produce coke for a foundry in Saginaw, Michigan. GM sold 2.814 acres along the southern boundary of the site to Outboard Marine Corporation (OMC) in 1969. In 1971, GM sold the remainder of the site to OMC. OMC demolished the coking plant shortly thereafter. The site is currently owned by OMC. The Waukegan Port District had an ownership interest in the site for a period from October 1988 to February 1991 (Chicago Title Insurance Co., 1991). Table 2.2-1 lists a history of the deed conveyances for the WCP site.

## 2.3 SITE OPERATIONS

### 2.3.1 Wood Treating Plant

Based on information obtained from the Elgin, Joliet and Eastern Railway Company (EJ&E, 1990), the first industrial facility located on the site was a wood treating plant. This operation was located on the western portion of the site (Figure 2.3-1) and was operated by the Chicago Tie and Timber Company from approximately 1908 to 1912. The plant consisted of at least four steel creosote storage tanks, a wood planing building, an overhead steel conveyor belt system, two creosote weighing vanes located due east of the storage tanks, and a storage building for the treated railroad ties (EJ&E, 1990; Sanborn, 1917; U.S. ACE, 1908). The storage building for the finished product and a 250-foot long, 8-foot high concrete retaining wall (connected to the south edge of the storage building) ran parallel to the EJ&E railroad side tracks.

Available information indicates that the untreated railroad ties were transported by the conveyor to the treating building where they were dipped in vats of creosote. The treated ties were likely transferred to the storage building for future distribution by rail or ship. It is not apparent from the existing data how or where the ties were dried. As a result, the possibility that ties were drip-dried on land used for the creosoting facility operations cannot be eliminated. Based on a review of Sanborn Fire Insurance Maps, the wood treating plant was dismantled sometime after 1917.

### 2.3.2 Waukegan Coke Plant

In 1927, EJ&E sold the entire property to the William A. Baehr Organization, which in turn sold the property to the North Shore Coke and Chemical Company. Between 1926 and 1928, a coke oven gas plant was designed and constructed under the direction of the William A. Baehr Organization. This gas plant sold their excess gas production to North Shore Gas Company.

The major structures present on the original gas plant site, as identified from a 1929 Sanborn Fire Insurance map, are shown in Figure 2.3-1 and listed in Table 2.3-1. Figure 2.3-2 outlines the manufactured gas/coke production processes used at the WCP site. The processes and facilities are described below.

The original plant included a large steel and concrete dock for coal unloading located on the western edge of the site along Waukegan Harbor. The western one-third of the site was used for coal storage, from which the coal was transported by drag line and belt conveyors to the coke ovens. The coke ovens consisted of 31 Koppers Company Becker-type ovens, each with a 9.1 ton capacity and an aggregate normal carbonizing capacity of 450 tons per day (Duff & Phelps, 1940).

Before the fall of 1937, some of the gas that was produced was used for the underfiring of the ovens. This practice limited gas production to 3,100,000 cubic feet per day. After the installation of a producer gas plant, which supplied the fuel requirements for the underfiring of the ovens, the daily production was increased to 5,200,000 cubic feet per day. The producer gas that was not used was often blended with the coke oven gas to obtain the desired Btu content and subsequently transmitted to North Shore Gas Company's distribution system (Duff & Phelps, 1940).

Coal tar and ammonia were by-products of the manufactured gas production. The coke company plant included equipment with which gas by-products were extracted and prepared for the market. Figure 2.3-1 shows the locations of the by-products building, tar tanks, tar storage tank, and ammonia tank.

In addition to by-product removal, operations at the site included removal of sulfur and naphthalene from the raw gas for gas purification. The gas was treated for sulfur removal on the Coke Company property using equipment owned by North Shore Gas Company (NSG), to whom the Coke Company sold its gas. The purified gas was sent by transmission pipelines for ultimate distributions to the NSG service territory (Duff & Phelps, 1940).

The gas purification operations used a liquid sulfur removal process (Thylox) and were conducted at the Thionizer building (Figure 2.3-1).

An on-site electric steam generating plant that supplied all of the steam and electricity required for plant operations was owned and operated by the Coke Company (Duff & Phelps, 1940). Steam was generated from two boilers located in the boiler house (Figure 2.3-1). The water used to generate the steam was pumped through a 24-inch intake pipe from Waukegan Harbor. In addition, a water well was located at the southwest corner of the boiler house and was completed at a depth of approximately 140 feet below the ground surface (Baehr Organization, 1927).

After the transfer of ownership to GM, the primary function of the plant was to supply coke for a foundry in Saginaw, Michigan. The production of coke oven gas was limited to internal use only due to the conversion of NSG to natural gas in 1947. The gas purification facilities and sulfur removal equipment were dismantled by GM because the coke oven gas was only used on-site.

According to a real estate appraisal description (Real Estate Research Corporation, 1971), the coal preparation and coking portion of the plant consisted of a coal mixing silo, coal preparation building, coke ovens, coke quenching station, domestic screen station, and coke screen and hammer mill building. A 225-foot chimney was located on the southwest corner of the oven. The following structures were located in close proximity or within the by-products building: four cast iron tanks and two gas pumps within the building, a surface tar tank, two steel cooling towers, and cooling coils. To the south of the by-products building was a small tank farm which consisted of three horizontal 15,000-gallon steel tanks, one of which was a tar cooker, as well as two vertical tanks, one for ammonia liquor storage and the other for tar storage.

The plant facilities were dismantled at the direction of OMC in approximately 1972. The specifications for demolition of the coke plant facilities provided for the removal of all of the buildings, smoke stacks,

equipment, railroad tracks, and ties (OMC, 1972). According to the specifications, bids were to include the removal of all foundations to 12 inches below grade and the complete removal of the foundations over the coke battery and the two smoke stack bases. The specifications called for removal from the site of any water, oil, tar or residue remaining in the oil or tar storage tanks, and prohibited disposal of oily water, oil, tar, or tar emulsions in the plant sewer system. Also included in the specifications for the dismantling of the plant was the filling and leveling of all depressed areas such as pits and sumps with incombustible rubble. The site presently is clear of all structures from the coking plant with the exception of the office building in the southeast corner of the site and the above-grade tar tank foundation at the south end of the site. There is evidence that many building foundations are also still present at the site.

### 2.3.3 OMC Operations

After the demolition and removal of the Coke Plant, OMC used the property for various operations and activities. A data processing building was constructed and is currently maintained on the southeastern portion of the property. Between 1973 and 1989, annual burning permits were obtained from the Illinois EPA for fire prevention and response training for OMC employees. The property has also been used for public parking for special events at the Waukegan public beach. During the winter of 1972-1973, snowmobile performance tests were run on a small track on a portion of the property. OMC's Engineering Department currently performs quality control and durability testing of their products using a tower in the southwest corner of the site (OMC, 1990).

OMC has also used portions of the site for temporary storage of construction materials and semi-trailers. In 1974, the Army Corps of Engineers contracted for the dredging of sand from Lake Michigan. The sands, which were tested and found to contain PCBs (EJ&E, 1990), were placed on the western edge of the site for temporary storage. The dredged spoils are still in-place. Between 1977 and 1980, OMC stored waste oil in two 15,000-gallon aboveground storage tanks in the vicinity of the gas producer building.

These tanks have since been removed. Containment areas for these tanks are still evident (Figure 2-3.1). During the summer of 1979, four enclosed trailers containing 11,000 gallons of waste oil were parked on the north edge of the site, approximately 50 feet south of Pershing Road (Sea Horse Drive) and 500 feet east of Larsen Marine. Furthermore, two 20,000-gallon tanks which stored gasoline for two to three years in the middle 1970s were located in the center of the site (OMC, 1990). No other information is currently available about these tanks. Larsen Marine has also leased portions of the site for the storage of boats and boat racks.

There is currently an aboveground storage tank farm on the southwestern corner of the site used in OMC's product testing operations. There are nine tanks with a capacity varying from 300 gallons to 20,000 gallons. The stored fuels consist of gasoline, fuel oil, and kerosene (OMC, 1990).

During the latter part of 1990, a contractor to OMC began construction of a new slip to be used for boat servicing. The new slip is located near the northwest corner of the site (Figure 2.3-1). The slip was designed to be 375 feet long by 175 feet wide with a narrowed entrance (Canonie, 1990b). Preliminary plans of the new slip (Canonie, 1991a) indicate that the slip as constructed is approximately 475 feet long. The new slip is intended to replace an existing slip, Slip No. 3, which is located west of the new slip across Waukegan Harbor, and is currently used for the boat servicing operations of Larsen Marine. Slip No. 3 is planned to be filled with PCB-contaminated sediments and subsequently capped as a remedial action for PCB contamination in the Waukegan Harbor.

The new slip constructed at the WCP site includes sheet pile walls and tie-back systems for its north and south borders and a slurry wall at the eastern end. An existing force main which traverses the new slip site was relocated. Designated contaminated soils (as defined in the Construction Specifications, Canonie, 1990b) excavated during the construction of the new slip were placed at the WCP site in a waste pile intended to meet RCRA guidelines. Soils not defined as designated contaminated soils were placed adjacent to the southeast face of the existing pile of dredge spoils.

#### 2.3.4 Site Definition

The WCP site is located in the City of Waukegan, Lake County, Illinois. According to a legal description from a real estate appraiser, (Real Estate Research Corporation, 1971), the site is located in the northwest quarter of Section 22, Township 45 North, Range 12 East of the Third Principal Meridian. The site is bounded to the north by Pershing Road (now Sea Horse Drive), on the east by Pershing Road (now Sea Horse Drive), on the South by OMC Plant No. 1, and on the West by Waukegan Harbor. The site is rectangular in shape with a total area of 36 acres.

Available information regarding site operations (OMC, 1990; GM, 1990; North Shore Gas, 1990; EJ&E, 1990; Duff & Phelps, 1940) indicates that industrial processes, product storage, and waste disposal associated with the site industrial facilities were conducted within the property boundaries. The site is, therefore, defined to be contained within the former property boundaries shown in Figure 2.3-1.

#### 2.4 PREVIOUS INVESTIGATIONS

##### 2.4.1 Waukegan Harbor PCB Studies

The Waukegan Harbor, which is the western boundary of the WCP site, has been the focus of studies addressing PCB contamination. Several studies have been completed that provide general information for the Waukegan area.

The Waukegan Harbor Superfund site was added to the National Priorities List ("NPL") by publication on the Federal Register on September 8, 1983 (48 Fed. Reg. 40658). In the Consent Decree entitled United States of America v. Outboard Marine Corporation (No. 8808-71), the Waukegan Harbor Superfund Site is defined to include, "Slip No. 3 of Waukegan Harbor, the Upper Harbor of Waukegan Harbor and the following areas located on OMC facility property: the North Ditch, Crescent Ditch and Oval Lagoon, and the Parking Lot" (Paragraph III I(V)).

PCB contamination was discovered at the Waukegan Harbor Superfund Site in the early 1970s. Between 1950 and 1971, OMC purchased an estimated 9 million pounds of PCBs from Monsanto. Public records indicate that an estimated 10 to 15-percent of the PCBs used in the hydraulic fluids of die-casting machines escaped into the floor drains and were discharged into a ditch north of the OMC die-casting plant and the Waukegan Harbor. Several studies were performed to characterize the extent of this contamination and its effects on the terrestrial and aquatic environments. Other studies have provided data pertaining to the geology, hydrogeology, demographics, and other general background information for the Waukegan Harbor and surrounding areas.

In order to clean up the Waukegan Harbor area, a dredging operation is proposed in the Record of Decision for the harbor area site. One of the remedies which would directly affect the WCP site includes the removal of PCB-contaminated sediments from Waukegan Harbor and their disposal in Slip No. 3. Slip No. 3 would be filled with the contaminated sediments and capped. As discussed in Section 2.3.3, a new slip (to replace Slip No. 3) has been constructed at the WCP site.

#### 2.4.2 1989 New Slip Soil Investigation

In 1989, Canonie Environmental, Inc. conducted a soil investigation for the construction of a new slip for the boat servicing facility. The results of the investigation were contained in the "Draft Data Summary Report-New Slip Soil Investigation" (Canonie Environmental, Inc., 1990a). The investigation consisted of a four-phase soil boring program and the installation of two nests of monitoring wells. Samples were collected from soil borings and monitoring wells and submitted for chemical analysis. Wells MW-2S and MW-2D were removed in the spring of 1991 during the new slip construction.

#### 2.4.2.1 Soil Boring Installation

In 1989, a four-phase soil boring and sample analysis program was performed for the New Slip Soil Investigation (Canonie, 1990a). These soil borings were located in the northwest quadrant of the WCP site (Figure 2.4-1). The first phase consisted of the placement of eight borings in January and February 1989. After chemical analysis of samples from one boring showed significant concentrations of polynuclear aromatic hydrocarbons (PAHs) and phenols, an additional six borings were placed around this boring (Phase 2) during February 1989. The next phase consisted of the placement of 35 borings distributed in and around the new slip location. These borings were placed during July and August of 1989. Finally, Phase 4 consisted of the placement of three borings located north of the new slip during September 1989.

#### 2.4.2.2 Monitoring Well Installation

Two nests of monitoring wells were installed southeast of the new slip location (Figure 2.4-1). Each nest contained a shallow and a deep well. The shallow wells had screens placed at the 12.5 to 17.5-foot depth interval while the deep wells had screens placed at the 23 to 28-foot depth interval. Monitoring Wells MW-2S and MW-2D were decommissioned during construction of the new slip.

#### 2.4.2.3 Soil Sampling

Selected soil samples were analyzed for PAHs and phenols. These chemical constituents are typically found at manufactured gas plants, coking plants, and wood treating sites. Most of the samples were not analyzed for volatile organic compounds (VOCs) which are also generally associated with coal tar products. The samples were not analyzed for PCBs with the exception of 10 deep samples which were a considerable distance from the harbor. The results of the analyses of soil samples are summarized in Section 3.5.

#### 2.4.2.4 Groundwater Sampling

The samples from the four monitoring wells were analyzed for phenols and PAHs. The results are summarized in Section 3.4.

#### 2.4.3 1990/1991 New Slip Soil Investigation

Additional soil investigations were performed in the new slip area by Canonie Environmental in November and December 1990 and January 1991. These investigations were performed to provide additional information for: (1) delineating areas of soils to be placed in the waste pile following excavation of the new slip; and (2) providing information on soil quality in areas affected by the extension of the slip toward the east. As of June 1991 when this document was written, only preliminary information on sampling locations, methods, and results were available (Canonie, 1991a). The final data report for the 1990/1991 New Slip Soil Investigation (Canonie, 1991b) was subsequently made available on October 5, 1991. The results of that final report will be incorporated into the Phase I Technical Memorandum of this remedial investigation.

The preliminary information indicates that the 1990/1991 soil investigations included placing soil borings and excavating a test trench in the vicinity of the new slip (Figure 2.4-1). Soil samples were collected from selected soil borings and analyzed for PAHs and phenols. Two samples were analyzed for volatile organic compounds. The preliminary information package did not include complete identification of sample locations for all reported analytical data, and data were not provided for all investigations proposed in the investigation plans (Canonie, 1990b). Summaries of the reported soil quality data were provided and are included in Appendix B. The U.S. EPA reports that a final report on the new slip soil investigations is in preparation.

#### 2.4.4 Illinois EPA Sampling

In June of 1989, the Illinois Environmental Protection Agency (IEPA) collected and analyzed a total of ten soil samples from seven soil borings which were located on the WCP site (Figure 2.4-1). An additional sample from an off-site soil boring was also analyzed. The samples were collected at depths of 6 feet or less below the ground surface and analyzed for phenols, PAHs, VOCs, pesticides, and metals (IEPA, undated). Section 3.5 includes a brief summary of available data for the soil sample analyses.

#### 2.4.5 OMC Test Trenching

Three test trenches approximately 3.5 feet in depth were dug northeast of the new slip location in early 1990. Information regarding the exact locations of these test trenches is not currently available. The trenching was videotaped and showed no evidence of oily substances in the soil. A 1-foot thick seam of coal fill was seen below approximately 8 inches of top soil in a test trench in the Larsen boat storage area, approximately 135 feet south of Pershing Road (Sea Horse Drive).

### SECTION 3

#### SITE DESCRIPTION

This section describes the site environment and the regional and local hydrogeologic setting of the area surrounding the WCP site. The section also summarizes the groundwater, surface water, and soil quality at the WCP site. Information contained in the following discussion was gathered from published state and federal geologic reports and from reports of studies of the OMC/Waukegan Harbor area, as presented in the list of references.

#### 3.1 SITE ENVIRONMENT

##### 3.1.1 Demographic Information

Waukegan is the county seat of Lake County with a 1980 population of 67,653. Built on a 50-foot bluff overlooking Lake Michigan, Waukegan is primarily a manufacturing community. Industries located in Waukegan include Outboard Marine Corporation, National Gypsum, Johns-Manville, and Abbott Laboratories.

Other than Chicago, Waukegan is the only city in Illinois with industrial harbor facilities. It is served by major railroad lines, highways, and expressways. In addition, a municipal airport is located in Waukegan.

##### 3.1.2 Climate

Waukegan has a typical continental climate characterized by frequent changes in temperature, wind direction, cloud cover, and humidity. Since the eastern edge of the site borders the shores of Lake Michigan, a breeze off of the lake can cause the temperature to remain 10°F to 15°F below inland temperatures during summer afternoons. The maximum average daily temperature during the warmest month of the year (July) is 82°F with an average daily

minimum of 62°F. The maximum average daily temperature during the coldest month of the year (January) is 29°F with an average daily minimum of 12°F.

Precipitation generally occurs as snowfall during the winter months and rainfall for the rest of the year. The total annual precipitation is approximately 33 inches. The average annual snowfall is 37 inches. The majority of the precipitation occurs between the months of April through September. The wind is primarily out of the west to northwest during the colder months and is out of the west to southwest during the warmer months (U.S. Department of Agriculture Soil Conservation Service, 1970; Hey and Philippi, undated).

### 3.1.3 Site Ecology

The Waukegan Coke Plant site is developed land which has been utilized for industrial uses since the early 1900s. The majority of structures on-site were removed by 1972 and the site has grown over with plant communities typical of disturbed upland. The vegetation of the site is a mixture of shrubby and weedy successional vegetation, with a common prairie species component occurring in places. Various species of coniferous and deciduous trees have been planted in places on the site for landscaping purposes (CH2M Hill, 1983).

In the Waukegan area are a state park and a public beach area. The southern boundary of the Illinois Beach State Park is situated approximately 1.5 miles north of the Waukegan Coke Plant. Waukegan public beach is situated east of the site, across Seahorse Drive and the beach parking area. The majority of the beach is comprised of unvegetated lake-deposited sand. Predominant plants in the beach area are sea rocket, winged pigweed and cocklebur (CH2M Hill, 1983).

Common invertebrates, small mammals, and birds are likely inhabitants of the project site. For example, spiders, beetles, grasshoppers, prairie deer mice, and eastern cottontail rabbits are typical occupants of successional vegetation communities. The shore of Lake Michigan likely serves as a

natural migration route and nesting area for a variety of bird species. Shorebird species such as gulls and black terns are common to the area. Due to the relative scarcity of vegetation on the site and the amount of human activity in the vicinity, the site likely does not provide exceptional habitat for any particular fauna (CH2M Hill, 1983).

The bald eagle, classified as endangered by the U.S. Department of the Interior, has been observed in the Waukegan Harbor area during migration periods (CH2M Hill, 1983). No other species of terrestrial biota currently on federal lists as endangered or threatened is known to be present in the area at any time during the year. No species of fish classified as endangered or threatened by the U.S. Department of the Interior area is known to inhabit the Waukegan area.

Fifteen species of birds and at least five species of plants classified as endangered in Illinois are known or likely to be present in the vicinity of the project site (CH2M Hill, 1983). Additionally, two bird species and one plant species classified as state threatened species have been observed in the vicinity of the site. Three fish species which are classified as state threatened species were collected in the Waukegan area in 1971. Of these (cisco, longnose sucker, and lake whitefish), only the lake whitefish has been reported since 1971 (CH2M Hill, 1983).

#### 3.1.4 Land Use

The land use around the WCP site is primarily industrial with the exception of the public beach which is separated from the eastern edge of the site by Pershing Road (Sea Horse Drive). Due west of the site is Waukegan Harbor. Land use on the west side of the harbor is predominantly railroad yards and light industrial facilities. The Waukegan central commercial district is located 3,000 feet west of the site. South, north, and west of the downtown area are residential areas, light industries, and recreational areas.

Waukegan is bordered by the City of North Chicago to the south and the City of Zion to the north.

The City of Waukegan Waterworks is located approximately 1,000 feet south of the WCP site and pumps its water from Lake Michigan. The Waukegan wastewater treatment plant is located approximately 3,000 feet north of the site and is operated by the North Shore Sanitary District. The Illinois State Beach Park is located approximately 1.5 miles north of the site.

### 3.2 REGIONAL HYDROGEOLOGIC SETTING

Waukegan is located in a glaciated area of Northeastern Illinois. The region is characterized by a series of north-south trending morainal ridges and intervening alluvial deposits that form the valley floors. Glacial deposits are interbedded with alluvial deposits associated with sedimentation and erosional processes related to Lake Michigan and its fluctuating water levels over the past 10,000 to 12,000 years (Reinertsen, et al., 1981).

The WCP site is located on a flat-lying peninsula which is separated from the mainland by Waukegan Harbor. The site is bounded on the south and east by Lake Michigan, and on the west by Waukegan Harbor. The peninsula lies at an average elevation of approximately 585 feet MSL.

Waukegan Harbor is a manmade structure constructed in the late 19th and early 20th centuries. Prior to construction of the harbor, the area located east of the original shoreline (i.e., the site location) was composed of a complex series of natural and manmade inlets and islands. Portions of the site and much of the site vicinity were filled and reclaimed.

#### 3.2.1 Unconsolidated Sediments

Surficial deposits in the vicinity of the site consist of shallow water near-shore lake sediments (beach, bar, spit, delta, lacustrine, and other wetland deposits) of the Dolton Member of the Equality Formation. These deposits are predominantly medium-grained sand with gravel. Underlying the

Equality Formation is a relatively thick unit of mostly gray clay and sandy clayey till with some pebbles and cobbles; this glacial deposit is termed the Wadsworth Till Member of the Wedron Formation. The total depth of unconsolidated deposits in the vicinity of the site is reported to be between 50 feet and 200 feet (Lineback, 1979; Hughes, et al., 1966).

The sand and gravel deposits within the glacial materials are used extensively for groundwater production in some areas. Where the deposits are thick and relatively continuous, pumping rates as high as 1,000 gpm are possible (Hughes, et al., 1966).

### 3.2.2 Bedrock Units

Underlying the unconsolidated deposits are the dolomitic (Silurian) Racine<sup>1</sup>, Waukesha, Joliet, Kankakee, and Edgewood Formations. Depth to bedrock is reported to be between 50 and 200 feet in the region. The bedrock topography is complex, having been eroded prior to and during the last glaciation. Bedrock valleys are present in the Waukegan area, several with total relief of more than 100 feet. Most of these valleys trend west to east. Below the dolomite lies Ordovician rocks, including: the Maquoketa Formation limestone and shales; the Galena-Platteville Formation limestone and dolomites with minor shale; the Ancell Formation (St. Peter Sandstone); and the Prairie du Chien Formation (Willman, et al., 1967).

The bedrock units form three major aquifer systems in northeastern Illinois. The uppermost shallow bedrock aquifer consists of the Silurian dolomites. The underlying Maquoketa Group shales hydraulically separate the Silurian aquifer from deeper units. The shallow bedrock aquifer is recharged through the glacial deposits and is generally in hydraulic connection with the glacial deposits and major surface water features.

---

<sup>1</sup>The Racine Formation may be as much as 500 feet thick. No site-specific data are available.

The deeper aquifer systems include the Cambrian-Ordovician aquifer and the Mt. Simon Aquifer. These hydrogeologic units are recharged where they outcrop or where they immediately underlie the glacial deposits. In general, the recharge areas are located to the north and west of Waukegan. The deeper units may also receive some recharge through the Maquoketa Group.

Regionally, groundwater is produced from all three bedrock aquifers with the majority of production from the Cambrian Mt. Simon Sandstone; however, few wells penetrate the Mt. Simon Aquifer in the immediate Waukegan area (Hughes, et al., 1966).

### 3.3 SITE HYDROGEOLOGIC SETTING

#### 3.3.1 Geology

The uppermost deposits at the site are composed of fill. The fill is approximately 2 to 4 feet thick. It varies in composition from fine to coarse, brown to black sand and is mixed with demolition debris (Canonie, 1990a).

The fill is reportedly underlain by a black to brown, fine to coarse sand unit that is likely composed of lacustrine and wetland deposits. Much of this unit at the site may have been disturbed during the harbor construction. It is likely composed of both natural in-place material mixed with other native material that was moved from nearby locations and placed at the site as fill. The unit ranges in thickness up to approximately 10 feet.

Underlying the black to brown sand is a gray sand unit composed of fine to medium sand with some silt. This unit is approximately 15 to 25 feet thick. Near the new slip location, the unit apparently extends to the surface and the black to brown sand unit is absent. Lenses of silty sand are also present within the gray sand unit.

Samples from the majority of soil borings placed in the vicinity of the proposed new slip (Figure 2.4-1) indicate the presence of a 1 to 3-foot thick

sand and gravel unit directly underlying the gray sand unit. Test holes completed in 1927 on the City Waterworks property (located approximately 1,000 feet south of the site; Figure 2.1-1) also encountered a gravel unit at the base of the gray sand.

Underlying the gravel (or directly underlying the gray sand where the gravel is absent) is a thick till deposit of gray silt and clay. This unit was also described (in a 1927 test hole located south of the coke ovens) as being blue and containing clay, stones, and pebbles. The till unit is reported to be approximately 50 to 200 feet thick regionally (Lineback, 1979). At a soil boring located near the new slip construction area, the unit was at least 30 feet thick; its base was not encountered. The boring completed as part of a well installation near the boiler room (prior to 1927) encountered the base of the till at an elevation of approximately 490 feet above mean sea level (MSL). At that location, the till was approximately 40 feet thick.

Underlying the till is a thick sequence of carbonate bedrock units. The only boring deep enough to penetrate the bedrock was the boring for the Boiler Room well. The top of the "limestone" unit was encountered at an elevation of 490 feet MSL (a depth of 91 feet). The well boring extended 43.8 feet into the limestone and no significant changes in lithology were noted. Regionally, the Racine, Waukesha, Joliet, Kankakee, and Edgewood Formations form the uppermost bedrock unit. Together, these units are reported to be in excess of 500 feet thick.

### 3.3.2 Groundwater Flow

Regionally, groundwater generally occurs under unconfined conditions in the surficial unconsolidated deposit and groundwater in the upper bedrock aquifer occurs under confined conditions. Lake Michigan acts as a major regional discharge zone for groundwater. Therefore, groundwater flow in both the surficial unconsolidated deposits and bedrock units in the region would typically be toward the lake.

Other than the placement of two monitoring well nests described in Section 2.4.2.2, no hydrogeologic studies have been conducted at the WCP site. However, a groundwater investigation (JRB, 1981) was conducted in the vicinity of the drainage ditch at the OMC Plant No. 2 located north of the WCP site (Figure 2.1-1). Additionally, a preliminary groundwater flow model was developed as part of a risk assessment for construction of the new slip.

#### 3.3.2.1 OMC Plant No. 2 Site Hydrogeology

Results of the hydrogeologic investigation completed for the OMC Plant No. 2 site (JRB, 1981) indicated that shallow groundwater at the site generally flowed to the east toward Lake Michigan; however, several other factors also had some effect in controlling the localized groundwater flow pattern. These factors included: (1) the water level in a drainage ditch north of OMC Plant No. 2; (2) precipitation events; (3) the presence of the till (silt) below the sandy near-shore lake deposits; and (4) fluctuation of the lake level.

Because the investigation focused on the area north of the OMC Plant No. 2 facility, horizontal hydraulic gradient information is available primarily for flow to and from the drainage ditch. Horizontal hydraulic gradients ranged from approximately  $6 \times 10^{-3}$  feet/foot to the southeast along the western boundary of the OMC Plant No. 2 site, to approximately  $8 \times 10^{-3}$  feet/foot in both a northerly and southerly direction along the drainage ditch. No information about horizontal hydraulic gradients was available for the WCP site which is located south of the OMC Plant No. 2 facility. Vertical hydraulic gradients in the surficial aquifer north of the OMC facility are reported to be in a generally upward direction (JRB, 1981).

Hydraulic gradients between the surficial aquifer and the Silurian bedrock were also reported to be in an upward direction (Canonie, 1989). One of the two piezometers installed into the Silurian bedrock reportedly flowed at the surface. Information on the magnitude of the upward gradient was not included in the Canonie report.

"Baildown" tests (slug tests) were conducted in 22 monitoring wells screened in the surficial unconsolidated materials at the OMC Plant No. 2 site. Hydraulic conductivities ranged from  $2 \times 10^{-4}$  cm/sec to  $9 \times 10^{-3}$  cm/sec (JRB, 1981).

#### 3.3.2.2 WCP Site Hydrogeology

Geraghty and Miller, Inc. (1990) prepared a single layer groundwater flow model of the WCP site. They used the USGS MODFLOW computer code to calculate hydraulic head distributions across the site and groundwater fluxes to the harbor. Site-specific hydrogeologic data were not available for actual groundwater flow conditions at the WCP site; therefore, the model could not be calibrated or validated. Results of the modeling predicted that groundwater flow would be to both Lake Michigan and Waukegan Harbor for the simulated conditions, with the divide located approximately down the center of the peninsula. Computed groundwater flow at the northern and southern boundaries of the site had a more southerly component as compared to computed flow at the center of the peninsula.

#### 3.3.2.3 Effects of New Slip on Site Groundwater Flow

In addition to modeling the current groundwater flow regime at the WCP site, Geraghty and Miller (1990) also modeled the effects of new slip construction on site groundwater flow. Using the model of current groundwater flow at the site as the base case, they added the new slip as an extension of the Waukegan Harbor constant head boundary.

Results of including the new slip in the model (Geraghty and Miller, 1990) indicated that the computed location of the divide separating groundwater flow between the harbor and the lake remained in approximately the same position, shifting slightly to the east. Computed overall horizontal gradients at the site increased somewhat at the northwestern boundary of the site. Computed groundwater flow directions in the immediate area of the slip appeared to change significantly relative to base case results. The computed total flux of groundwater entering the harbor

increased slightly with the new slip. The computed groundwater flux through the slip area itself increased significantly following slip construction.

The design of the new slip has changed since the groundwater modeling was performed. The slip location has been moved north, its orientation shifted, and a slurry wall has been added at the eastern end (Canonie, 1990b and 1991). Because the reported modeling did not account for these design factors, the model results are not representative of potential impacts of the slip as constructed.

### 3.4 WATER QUALITY

#### 3.4.1 Groundwater Quality

As mentioned in Section 2.4, the installation of two nests of monitoring wells on the WCP site was included in the New Slip Soil Investigation. The monitoring wells were installed east of the new slip location. Each nest contained a shallow and a deep well with depth intervals of 12.5 to 17.5 feet for the shallow wells and 23 to 28 feet for the deep wells. Samples obtained from the four monitoring wells were analyzed for phenols and PAHs (Canonie, 1990a).

Results of the chemical analyses performed on the groundwater samples indicate that total phenols were detectable at levels of 130 to 296 mg/L in samples from the deep wells. Phenols were reported at a total concentration of 0.01 mg/L in a sample from one of the shallow wells, and were below detection limits in the sample from the other shallow well. PAHs were detected at a concentration of 1.3 mg/L (total PAHs) in the sample from one of the shallow wells and were below detection limits in the sample from the other shallow well. Although no detectable concentrations of PAHs were reported for the analyses of samples from the two deep wells, the detection limits for PAHs were elevated due to the high concentrations of phenols that were present in those samples. The groundwater samples were not analyzed for volatile organic compounds that are commonly associated with coking and coal gasification sites. The groundwater quality data are included in Appendix A.

#### 3.4.2 Surface Water Quality

Extensive studies have been performed to determine the extent of PCB contamination in the Waukegan Harbor. There are no surface waters on the WCP site, but the western border of the site is the Waukegan Harbor. No sampling has been performed to determine if PCBs have migrated on-site.

#### 3.5 SOIL QUALITY

As part of the 1989 and 1990 New Slip Soil Investigations (Canonie, 1990a and 1991a), numerous soil borings were placed in and around the location of the proposed new slip. Laboratory analyses performed on soil samples from these soil borings reported total PAH concentrations ranging from non-detectable levels up to 27,000 mg/kg. The highest concentrations were reported for samples collected near the southern boundary of the new slip. PAHs were detected in samples collected to depths of 25 feet below the ground surface. The nature and extent of soil contamination is not fully defined since samples from the soil borings were generally not analyzed for PCBs (i.e., for samples from less than 15 feet in depth) or for volatile organic compounds (VOCs). Soil quality data from these studies are included in Appendix B, along with figures illustrating Canonie's interpretations of the extent of PAHs and phenols in soils.

A study performed by the Illinois Environmental Protection Agency in June of 1989 included the collection and analysis of ten samples from on-site soil borings. Four of the samples were collected near the by-products recovery area, and one of the samples was taken in the gas production area. The remaining five samples were collected at the northern half of the site. The samples were collected between zero and 6 feet in depth. The samples were analyzed for phenols, PAHs, VOCs, pesticides, and metals. Laboratory analyses of the soil samples showed significant concentrations of PAHs, VOCs, and selected metals. The available information on sampling locations and analytical data sheets are included in Appendix C. Detected PAH concentrations were highest near the tar storage and by-products recovery area. The sample collected near the thionizer building had elevated levels

of arsenic and cyanide, and elevated mercury concentrations were reported for the sample collected from the northeast portion of the site.

## SECTION 4

### INITIAL EVALUATION

#### 4.1 INTRODUCTION

This section presents an initial evaluation of the WCP site. It includes a summary of the types of contamination which have been identified at the WCP site and an assessment of other chemicals of concern which may potentially be associated with past industrial processes and waste disposal practices at the facility. The initial evaluation of chemicals of concern provides a framework for planning RI activities. The possible presence of other chemicals will also be evaluated during the RI (Section 6). The initial evaluation presented below includes a discussion of preliminary risk characterization issues and a discussion of processes for identifying ARARs.

Chemicals which may be of concern at the site were identified based on the results of previous site investigations, the types of wastes and by-products typical for coal gasification/coking plants and wood treating facilities (Table 4.1-1), and chemicals identified in studies of the OMC/Waukegan Harbor site. This section also includes a brief summary of physical and chemical characteristics of the chemicals of concern.

#### 4.2 IDENTIFIED CONTAMINATION

The investigations of the new slip area described in Section 2.4 identified oily soils containing polynuclear aromatic hydrocarbons (PAHs) and phenolic compounds. Soil investigations have identified contamination to depths of 25 feet below the surface, at the contact between the sand unit and the underlying till (Section 3.5). The lateral extent of contamination was not defined in detail to the east or south of the new slip area. The 1989 and 1990/1991 investigations of the new slip area also identified PAH and phenolic compounds in groundwater (Section 3.4.1).

The June 1989 investigation conducted by the IEPA (Section 2.4) identified PAH compounds in the shallow soil samples collected at several locations across the site. In addition, phenolic, volatile, and inorganic compounds were reported for some samples (Section 3.5).

#### 4.3 POTENTIAL CHEMICALS OF CONCERN

The waste types and associated chemicals of concern typical for coking and coal gasification facilities are well documented (GRI, 1987). At the WCP site, the list of chemicals of concern must also address chemicals that may be associated with the former wood treatment facility in the western portion of the site and wastes from adjacent OMC operations that may have been disposed of on the site.

Coking, coal gasification, and wood treating processes may each have resulted in the release of coal tar products and sludges to the environment. Coal tar or creosote can migrate as a separate, nonaqueous phase in soil and groundwater systems. In addition, dissolved compounds of coal tar or creosote can migrate with surface water, water infiltrating through soils, and groundwater flow. Coal tar and sludges are composed of hundreds of different compounds including PAHs, phenols, and volatile aromatics. Metals and inorganic compounds contained in oils, by-products, and wastes associated with coal tar may also be present. Table 4.1-1 presents a list of chemicals likely to be of concern at the WCP site as a result of coking, coal gasification, and creosoting operations (GRI, 1987).

In addition to the chemicals listed in Table 4.1-1, PCBs may be present at the WCP site because of the use of these chemicals at adjacent OMC facilities. PCBs are included as potential chemicals of concern due to past disposal of PCB-contaminated dredge spoils on the WCP site and presence of PCBs in Waukegan Harbor sediments. Other potential chemicals of concern include benzene, ethylbenzene, toluene, and xylenes (BETX) which may be associated with fuel and oil storage areas.

#### 4.4 PHYSICAL AND CHEMICAL CHARACTERISTICS OF POTENTIAL CONTAMINANTS

The following section presents generalized discussions of relevant physical and chemical characteristics of potential contaminants which may be present at the WCP site.

##### 4.4.1 Coal Tar

Coal tar, whether from a manufactured gas plant or a coking facility, is a by-product of coking bituminous coal. The constituents of a typical coal tar from a coal carbonization process are summarized in Table 4.4-1.

Coal tar is only slightly soluble in water, and may be present in soils and groundwater as a separate nonaqueous phase fluid. Coal tar generally discolors and leaves a distinctive oily residue in materials it encounters. Coal tar is more dense than water and may migrate as a separate phase primarily under the influence of gravity. Downward migration of coal tar will generally be limited when a contact with low permeability material is reached. Lateral migration may then be controlled by the slope of that contact. Pockets of concentrated coal tar are likely to be persistent because the mixing with groundwater required for solubilization and the aeration required for biodegradation are likely to be very limited in the subsurface environment. The PAH and volatile aromatic compounds of concern typically associated with coal tars are listed in Table 4.1-1.

##### 4.4.2 Creosote

Creosote is produced from a blend of the fractional distillates of coal tar. This blend may be diluted with coal tar or petroleum oil; consequently, the chemical composition and properties of creosote are not uniform. Creosote is generally described in terms of its physical properties, summarized in Table 4.4-2 along with the corresponding properties for coal tar. One of the principal differences evident from Table 4.4-2 is that the fraction of pitch (residue above 355°C) is much higher in coal tar than in creosote. Environmental fate and transport properties of creosote are

similar to those described above for coal tar, although creosote may be more mobile than coal tar due to its lower viscosity and differences in surface tension.

#### 4.4.3 Dissolved Organic Compounds

##### 4.4.3.1 PAH Compounds

The PAH compounds listed in Table 4.1-1 are relatively stable, exhibiting low volatilities and aqueous solubilities (Table 4.4-3). The octanol/water and sediment/water partition coefficients reported for PAH compounds indicate that higher molecular weight PAHs have a strong tendency to adsorb onto soils and sediments; therefore, the compounds are relatively immobile in the environment. PAH compounds as a group are generally biodegradable, with the lower molecular weight compounds generally showing a greater degree of biodegradability than the higher molecular weight PAHs.

##### 4.4.3.2 Volatile Organic Compounds

The volatile organic compounds typically associated with coking and coal gasification sites are BETX compounds. These compounds are significantly more volatile and soluble than the PAH compounds discussed above (Table 4.4-3). The BETX compounds are typically adsorbed onto soils and sediments to a lesser degree than the PAH compounds, indicating that BETX compounds are relatively mobile in the subsurface. Benzene is likely to be the most significant of the BETX compounds from an investigative standpoint because of its high solubility and mobility and comparatively low regulatory standards. The volatile aromatics are generally biodegradable.

##### 4.4.3.3 Phenolic Compounds

Table 4.1-1 includes four phenolic compounds identified as potential chemicals of concern. Phenolic compounds are relatively soluble and mobile compared to PAH compounds and are readily biodegradable.

#### 4.4.4 Inorganic Compounds and Metals

Inorganic compounds and metals which may be of concern at coking and coal gasification sites are listed in Table 4.1-1. The environmental fate and transport characteristics of these constituents vary. The Thylox system used at the WCP, unlike the wood-chip system used at some manufactured gas plant sites, used arsenate compounds and produced thiosulfates and thiocyanates. The environmental fate and transport of arsenic and cyanide compounds vary with the nature of the specific chemical compounds and with the transport medium characteristics.

#### 4.4.5 PCB Compounds

PCB compounds are synthetic chlorinated aromatic organic chemicals that were used in lubricating oils. These compounds are very stable in the environment. PCBs typically have low solubilities and high octanol/water partition coefficients, indicating a strong tendency to be adsorbed onto soils and sediments. The compounds are therefore relatively immobile in the subsurface environment. Individual PCB compounds vary significantly in their tendency to undergo biodegradation.

### 4.5 CONCEPTUAL SITE MODEL

Based on the existing information describing waste type, waste disposal, potential migration pathways, and potential receptor populations, a conceptual site model has been developed. The conceptual site model describes the expected sources of contamination, types of contaminants, potentially affected media, potential routes of migration, and potential human and environmental receptors.

#### 4.5.1 Sources

Two potential sources of contamination are documented to have existed at the property. The first is the former railroad tie and wood treating plant

located on the west side of the site. The second is the manufactured gas/coking plant formerly present on the eastern portion of the site.

The wood preserving and waste disposal practices of the former railroad tie and wood treating plant are unknown. Drippings from treated ties, spillage during processing, leaks and spillage from creosote storage or transfer areas, and disposal of process wastes are likely sources of contamination. There are no structures associated with this operation visible on-site.

The waste disposal practices of manufactured gas/coking facilities included collection and sale of by-products such as tar and ammonia. Gas was purified on-site prior to the transfer of site ownership to GM. The disposition of Thylox wastes is not known. Contaminant source materials may include tars, tarry soils, and contaminated groundwater. There are no identified waste disposal areas. If contamination is present, it may be associated with spills, leaks, and condensation associated with structures such as gas holders. The lateral and vertical extent of waste materials is unknown. Except for the office building and above-grade tar tank foundation, there are no existing aboveground structures. Many facility foundations may be present at the site.

Possible sources of wastes at the site include creosote, coal tars, and Thylox wastes. Section 4.3 summarized the potential categories of contaminants associated with coal tar and creosote. They include:

- Polynuclear aromatic hydrocarbons (PAHs);
- Phenolic compounds;
- Volatile aromatic compounds such as benzene, ethylbenzene, toluene, and xylene; and
- Metals and cyanide.

#### 4.5.2 Contaminant Migration

The potential contaminant migration pathways depend on the location of the waste and contaminated media. The nature and extent of the contamination is not defined. Shallow groundwater at the site is believed to move through the sand unit and discharge directly to Waukegan Harbor and Lake Michigan. Deeper groundwater is reported to show upward gradients, based on regional information, and is isolated from shallow groundwater by the presence of the till unit at a depth of approximately 25 feet below the ground surface.

The mechanisms for contaminant release and migration are illustrated in Figure 4.5-1. The potential contaminant migration mechanisms for the site include:

- Movement of tars downward to the sand/till contact and subsequent horizontal movement controlled primarily by the slope of the till;
- Leaching of contaminants from source materials and contaminant migration to the groundwater;
- Leaching of contaminants from tars and tar-saturated soil by groundwater;
- Movement of dissolved phase constituents with groundwater and discharge to Waukegan Harbor and/or Lake Michigan;
- Release of fugitive dust to ambient air through wind-driven and mechanical erosion if contaminants are present in surface soil; and
- Volatilization and upward diffusion of constituents from the unsaturated zone to the ambient air.

The movement of specific constituents will be a function of their physical and chemical properties. Of the chemical constituents likely to be of concern, the volatile aromatics, phenolics, and lower molecular weight

PAHs (e.g., naphthalene and acenaphthene) are most mobile in a soil-groundwater matrix and may be released to the groundwater. The volatile aromatics and lower molecular weight PAHs are most mobile in a soil-air matrix and may volatilize and diffuse to the ambient air. The higher molecular weight PAHs and metals are more likely to remain bound to a soil matrix and have limited mobility.

#### 4.5.3 Potential Exposure Pathways

The preceding sections have identified the potential contaminants of concern, the site's physical setting, and the potential release and migration mechanisms believed possible for the WCP site. Based on this information, potential exposure pathways for the site may be preliminarily identified. A list of potential exposure pathways for the site is presented in Table 4.5-1. This table includes potential pathways under current and potential future site uses.

Several potential pathways may not be likely because of the site characteristics as identified in Table 4.5-1. For example, the potential for human exposure to hazardous constituents in groundwater through the use of the groundwater as a water supply is not considered likely. There is no current groundwater use in the vicinity of the site. Private water supply wells are not permitted by the City of Waukegan Zoning Ordinance except where expressly authorized by the City Engineer, Director of Water Utility, and City Council (City of Waukegan, 1988). A readily available water supply exists from the City of Waukegan system, and future uses of the site that required drinking water supplies would be required to receive potable water from the municipal system (City of Waukegan, 1988).

The existing potential exposure pathways are limited. They include:

- Exposure of recreational users of the harbor (i.e., boaters and fishermen) to compounds released to the surface water from groundwater discharge;

- Exposure of aquatic organisms in the harbor to compounds released to the surface water from groundwater discharge;
- Exposure of people consuming fish from the harbor if the fish accumulated compounds that had been released to the surface water;
- Direct contact of site visitors with waste residuals present in surface soil; and
- Inhalation of contaminated dust or volatile compounds released to the ambient air.

The consequences of the exposures associated with surface water depend on the amount of hazardous constituents actually being released, the dilution of the groundwater as it discharges into the surface water, the environmental fate of the constituents (e.g., degradation and attenuation), and the likelihood of contact with the exposure medium. Much of this information is currently unknown.

The identification of potential exposure pathways considered the potential for future use and development of the site. The overall plan for the installation of the new boat slip includes development of the northwestern portion of the site for recreational boat storage and servicing. The City of Waukegan Building Commissioner has indicated that he is not currently aware of any viable development plans for the site or adjacent water front areas. However, long-term development desires include such ideas as condominiums and recreational land use once existing contamination problems are resolved. A boat launch project proposed by the Waukegan Port District has been canceled.

Based on the City of Waukegan Zoning Ordinances and Comprehensive Land Use Plan (City of Waukegan, 1988), future site uses most logically would include continued industrial and marine/commercial/recreational (i.e., boat storage and servicing) use of the property. In addition, utility line repair

or installation may result in exposures to wastes or waste constituents in the future.

An assessment of the potential effects of new slip construction was performed by Geraghty and Miller (G&M, 1990). This assessment was based on limited information. It identified and evaluated the following exposure pathways associated with the new slip:

- Exposure of boat yard workers;
- Exposure of marina visitors;
- Exposure of utility workers;
- Exposure of OMC workers and trespassers; and
- Exposure of people consuming fish.

#### 4.5.4 Potentially Exposed Populations

The site is located in a primarily industrial and marine commercial use area. The harbor is used for industrial purposes such as delivering gypsum and cement, and for access by recreational boats to the boat servicing facilities at the north end of the harbor. There are public beaches located east of the site. The water intake for the City of Waukegan is located more than 6,000 feet east-southeast of the site.

The potentially exposed human populations include OMC workers, trespassers onto the site, utility workers (if excavation occurs), future occupants of the site, people who may come into contact with water in the harbor and new slip (e.g., boaters, fishermen), and people who consume fish from the harbor. Aquatic organisms in the harbor are potentially exposed. Terrestrial organisms that come on-site are potentially exposed to contaminated soil.

#### 4.6 PRELIMINARY RISK ASSESSMENT AND IDENTIFICATION OF DATA GAPS

Exposure to chemicals associated with manufactured gas/coke plant and creosoting wastes are known to have potential human health and environmental effects if present in sufficient quantities. Benzene and several PAHs (e.g., benzo(a)pyrene) are potential human carcinogens. Several of the identified constituents, such as naphthalene and cyanide, can have potential adverse effects on aquatic organisms.

There are no known current exposures to any residual wastes or waste constituents. The most likely potential exposure pathways are: (1) direct contact if the site is disturbed; and (2) release of contaminated groundwater to surface waters. Exposure of aquatic organisms is the most significant exposure pathway if contaminated groundwater discharges to the harbor.

##### 4.6.1 Preliminary Risk Characterization

Although it is possible to identify the potential exposure pathways for this site, there is not sufficient information on the nature and extent of contamination associated with the manufactured gas/coking facility and railroad tie creosoting plant to perform a quantitative risk assessment.

##### 4.6.2 Identification of Data Gaps

The following data gaps are identified and will need to be addressed prior to the completion of a risk assessment:

- Characterization of groundwater quality;
- Estimates of potential impacts of groundwater discharges on surface water quality;
- Nature and extent of soil contamination; and

- Further definition and assessment of potentially exposed populations.

## SECTION 5

### DEVELOPMENT OF PRELIMINARY REMEDIAL ACTIONS

#### 5.1 INTRODUCTION

The development of preliminary remedial actions during the scoping of the RI has several objectives:

- To better define the degree of detail necessary in delineating the extent of groundwater and soil contamination;
- To identify data needed for evaluation of remedial action technologies; and
- To allow early identification of ARARs that may influence the scope of RI activities.

Remedial action objectives are first developed here based on the evaluation of the existing data and potential risks at the site. Following the statement of objectives, remedial technologies and process options are delineated and screened. Following this screening, a list of preliminary remedial actions is presented. Processes for identifying action-specific ARARs for remedial alternatives are discussed.

The initial listing of potential remedial alternatives presented below has been developed based on engineering judgment and similar evaluations from similar sites.

#### 5.2 REQUIREMENTS FOR REMEDIAL ACTION OBJECTIVES

Under CERCLA (as amended by SARA), the statutory scope of remedial actions at the site includes the following general objectives:

- To attain a degree of cleanup of hazardous substances, pollutants and contaminants released into the environment and a degree of control of further releases, at a minimum, which assures protection of human health and the environment;
- Preference should be given to selection of remedial actions for treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element; documentation must be provided if a permanent solution using treatment or recovery technologies is not selected; and
- The remedial action selected will, to the extent practicable, be consistent with the NCP, be cost-effective, and utilize relevant and appropriate criteria under the circumstances of a particular release. The degree of cleanup selected will assure protection of human health and the environment.

The NCP (40 CFR 430[f][1]) lists the following general objectives for selection of a remedy:

- Each remedial action selected shall be protective of human health and the environment;
- On-site remedial actions selected must attain those ARARs that are identified at the time of the Record of Decision signature or provide grounds for invoking a waiver;
- Each remedial action selected shall be cost-effective provided that it first satisfies the threshold criteria (i.e., protectiveness and attainment of ARARs); and
- Each remedial action shall utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

### 5.3 PRELIMINARY IDENTIFICATION OF SITE-SPECIFIC REMEDIAL ACTION OBJECTIVES

Site specific remedial action objectives aimed at protecting public health and the environment specify:

- A contaminant of concern;
- Exposure routes and receptors;
- Acceptable contaminant level or range of levels for each exposure medium (i.e., a preliminary remedial goal).

The risks identified in the risk assessment, along with the identification of ARARs for the site, will establish the specific goals (contaminant levels) for remedial actions. Based on the information presented in the initial evaluation the following preliminary objectives and associated goals have been identified:

1. To provide adequate protection to the public health and environment from direct contact, inhalation or ingestion of hazardous constituents in soils within a specified depth of the ground surface at the site.
2. To provide adequate protection to the public health and environment from direct contact, ingestion, or inhalation of hazardous constituents that currently or in the future discharge to the surface waters east and west of the site, including Lake Michigan and the Waukegan Harbor.

### 5.4 PRELIMINARY IDENTIFICATION OF SITE-SPECIFIC ARARs

Remedial actions must attain the standards defined by the ARARs established by U.S. EPA and Illinois EPA for the site, unless a waiver is obtained. Remedial action must also take into account the "to be considered" criteria or guidelines if the ARARs do not address a particular situation.

#### 5.4.1 Definition of ARARs

Applicable requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance. For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy all of the jurisdictional prerequisites of that requirement.

Relevant and appropriate requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. In some circumstances, a requirement may be relevant but not appropriate for the site-specific situation.

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant, and (2) determination if a requirement is appropriate. In general, this involves a comparison of a number of site-specific factors with those addressed in the statutory or regulatory requirement. The factors that are compared include the characteristics of the remedial action, the hazardous substances present at the site, or the physical circumstances of the site. In some cases, a requirement may be relevant but not appropriate, given site-specific circumstances; such a requirement would not be an ARAR for the site. In addition, there is more discretion in the determination of "relevant and appropriate" than for "applicable" requirements; it is possible for only part of a requirement to be considered relevant and appropriate in a given case.

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories,

guidelines, or proposed standards that may provide useful information or recommend procedures if no ARARs address a particular situation or if existing ARARs do not provide protection. In such situations, these "to be considered" (TBCs) criteria or guidelines should be used to set remedial action levels. Examples of criteria to be considered are reference doses (RfDs) and potency factors for ingestion of noncarcinogenic and carcinogenic compounds used in the risk assessment.

#### 5.4.2 Type of ARARs

Three classifications of requirements are defined in the ARAR determination process: chemical specific, location specific, and action specific.

Chemical-specific ARARs are usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of special locations include floodplains, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements can come into play. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved.

#### 5.4.3 Process for Identification of Preliminary Site-Specific ARARs and Preliminary Remediation Goals

A draft ARAR and Preliminary Remediation Goal (PRG) Technical Memorandum has been prepared for submittal to the EPA. The ARAR and PRG Technical Memorandum contains a preliminary identification of ARARs and develops preliminary remediation goals for the site. This memorandum is based on preliminary site information and the preliminary identification of remedial alternatives.

The purpose of the ARARs section is to identify the Federal and State environmental laws, regulations, criteria, advisories, and guidance that are likely to affect the remedial investigation and the evaluation of remedial actions at the WCP site. The ARAR and PRG Technical Memorandum identifies State and Federal requirements that may be applicable or relevant and appropriate for the site. It also identifies those requirements that may not be applicable or relevant and appropriate.

The purpose of the discussions of remediation objectives contained in the ARAR and PRG Technical Memorandum is to identify key contaminants, approaches, and concepts that will be used in risk assessment work, including the development of preliminary remediation goals. The remediation objectives section addresses such issues as site land use, identifying the contaminants that are most significant in the risk assessment process, refining the site model, and development of plausible exposure scenarios. Information from the ARARs section will be integrated with this information to develop preliminary remediation goals for the site media.

The draft ARAR and PRG Technical Memorandum has been prepared for submittal to the U.S. EPA Region V and Illinois EPA for review prior to commencement of the Phase I site investigation. The memorandum summarizes the most important ARAR and risk assessment issues and requests agency interpretation of these issues so that they may be used during the RI. The Phase I site investigation will begin following receipt of the U.S. EPA and Illinois EPA response to the ARAR and PRG Technical Memorandum.

The draft ARAR and PRG Technical Memorandum will be revised and updated based on the U.S. EPA and Illinois EPA comments and the findings of the Phase I site investigation. The revised ARAR and PRG Technical Memorandum will be submitted to the U.S. EPA and Illinois EPA following the Phase I site investigation. The Phase II site investigation will begin after receipt of the U.S. EPA and Illinois EPA review and comments on the revised ARAR and PRG Technical Memorandum. The assessments in the ARAR and PRG Technical Memorandum will be based on the most current understanding of the site and of Federal and State regulations and may change as site circumstances and the understanding of the site evolve.

#### 5.5 INITIAL DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section provides a preliminary discussion of potential remedial alternatives for the site. The initial list of remedial alternatives considered is presented in Figures 5.5-1 and 5.5-2. Potentially applicable remedial alternatives were selected based on the anticipated chemicals of concern at the site and the anticipated types of contaminated media, i.e., soil and groundwater. A wide range of potential alternatives have been identified to give the decision makers a range of options and allow comparison of different alternatives. Potential remedial alternatives are presented separately for soils and groundwater, though soil quality and groundwater quality are closely interrelated and many remedial alternatives for soil will likely have a positive impact on groundwater quality, and vice versa. Remedial alternatives for soils and groundwater are described in the following sections.

A literature review of the most attractive technologies has been used to evaluate the need for trustability testing for the WCP site RI/FS. This review is documented in the Treatability Study Technical Memorandum.

#### 5.5.1 Remedial Alternatives for Soils

The following soil remediation alternatives have been identified as potentially applicable at this site:

- No Action
- Monitoring and Institutional Controls
- Containment
- Biological Treatment
- In Situ Soil Flushing
- In Situ Stabilization/Solidification
- In Situ Vitrification
- In Situ Vapor Extraction
- Excavation
- On-Site Vault
- Off-Site Disposal
- Thermal Treatment
- Soil Washing

The following paragraphs provide brief descriptions of the potential remedial technologies for soils at the site. The following paragraphs also include a discussion of additional data that will be collected during this remedial investigation to assist the initial screening evaluation of specific remedial technologies.

The Treatability Study Technical Memorandum discusses additional data needs and treatability work that may be performed as part of the final selection and design of the remediation technologies for the site.

##### 5.5.1.1 No Action

The no action alternative is not a remedial action technology but is evaluated as a baseline for comparison with other technologies under consideration.

#### 5.5.1.2 Monitoring and Institutional Controls

Monitoring and institutional control could be implemented in conjunction with any of the other remedial alternatives. This alternative consists of site access and use restrictions to protect human health or the environment from direct contact, ingestion, or inhalation of hazardous constituents found in soils at the site. The soil monitoring would consist of verifying the integrity of the site access and use restrictions. Soil monitoring could also be used to verify the long-term performance of other remedial alternatives, using soil borings, soil gas probes, vadose zone soil-pore liquid sampling, or remote sensing of underlying groundwater.

#### 5.5.1.3 Containment

Containment technologies control the migration of hazardous constituents while maintaining the contaminated soils in their existing location. Containment technologies include barriers to control vertical and horizontal migration. A cap is a horizontal barrier which reduces infiltration. Capping alternatives include soil cover, clay, synthetic membranes, asphalt, and composite caps.

Vertical barriers are used to reduce horizontal migration. Vertical barriers include slurry walls, grout curtains, and sheet pile which are typically keyed into an underlying low permeability unit. This remedial investigation will collect information that is necessary to evaluate the effectiveness and implementability of vertical barriers including the depth to the low permeability unit, the vertical permeability of the lower unit, and the physical characteristics of the overlying soils.

#### 5.5.1.4 Biological Treatment

Biological treatment involves providing conditions suitable to the growth of and metabolism by microbes capable of transforming contaminants in to non-hazardous compounds. Biological treatment of soils can be performed in situ by providing nutrients and oxygen and ensuring that the microbial

population and soil environment are satisfactory for biodegradation of the target compounds. Land treatment is an above ground method of biological treating excavated soils. Land treatment involves maintaining soil aeration and mixing by tillage and maintaining proper nutrient, pH, and moisture conditions for the degradation of the target compounds. Data requirements for the initial evaluation of biological treatment will be met by the planned soil and groundwater characterization. The RI/FS will include field measurements of dissolved oxygen and redox potential, which will provide some information about the indigenous microbial population.

#### 5.5.1.5 In Situ Soil Flushing

In situ soil flushing is an emerging technology in which a flushing solution is used to remove contaminants and residual product from the soil. The flushing solution is usually water with additives such as an alkaline agent, polymers, and surfactants. The alkaline agent and surfactant act to lower the interfacial tension between the water and the organic contaminant, thereby allowing the solution to more effectively wash the soil. The polymer is added to achieve a viscosity in the flushing solution to match that of the contaminant product to be displaced.

#### 5.5.1.6 In Situ Vitrification

In situ vitrification is the electrical melting of soils at high temperatures to provide pyrolytic destruction of organic contaminants and immobilization of inorganics within the vitrified mass. The presence of a shallow groundwater table under the site may make this technology infeasible.

#### 5.5.1.7 In Situ Stabilization/Solidification

Stabilization/solidification processes reduce the mobility of contaminants by one or more of the following mechanisms: (1) encapsulation within a low permeability mass; (2) chemical binding the contaminant to a nonhazardous fixation material; and (3) altering the contaminant to be more inert or to bind with the fixation material. This technology may also be

performed aboveground on excavated soils. The remedial investigation will include soils characterization including particle size distribution, porosity, and total organic carbon content that will allow evaluation of the feasibility of this technology.

#### 5.5.1.8 In Situ Vapor Extraction

In situ vapor extraction is the removal of volatile compounds from soil in the gas phase using a system of wells screened in the vadose zone, vacuum pumps, and possibly an air treatment system. This technology would only be applicable if volatile contaminants were encountered at the site.

#### 5.5.1.9 Excavation

Excavation of contaminated soils is a remedial technology that is an essential component of several treatment and disposal alternatives. The shallow water table under the site increases the difficulty of deep excavation at the site.

#### 5.5.1.10 On-Site Vault

This alternative involves the excavation of contaminated soils and subsequent placement in a controlled, on-site vault. The soils are not remediated but are contained to prevent further contaminant migration.

#### 5.5.1.11 Off-Site Disposal

This alternative involves the excavation of contaminated soils and subsequent placement in a controlled, off-site facility. The soils are not remediated but are contained to prevent further contaminant migration.

#### 5.5.1.12 Thermal Treatment

Thermal destruction technologies include fuel blending, incineration, pyrolysis, thermal desorption, and infrared thermal treatment which can be performed on excavated soils. These technologies provide essentially complete destruction of organic contaminants. Samples of coal tar contaminated soils and free tars which are deemed to be possible candidates for incineration will be analyzed for gross heating value to assist in the evaluation of thermal treatment alternatives and costs.

#### 5.5.1.13 Soil Washing

Soil washing is an emerging technology performed in above ground reactors with excavated soils. Soil washing involves the use of chemicals and/or physical operations to segregate the contaminants from the bulk soil matrix and then to concentrate them to reduce the volume of residuals that are handled by a different remedial technology such as disposal, incineration or biological treatment.

### 5.5.2 Remedial Alternatives for Groundwater Impacts on Surface Waters

The following remediation alternatives have been identified as potentially applicable for controlling potential groundwater impacts on surface waters:

- No Action
- Monitoring and Institutional Controls
- Containment
- In Situ Biological Treatment
- Groundwater Extraction
- Groundwater Treatment and Discharge

The following paragraphs provide brief descriptions of the potential remedial technologies for groundwater at the site. Any additional data

beyond the scope of the typical remedial investigation needed to evaluate specific remedial technologies is also discussed.

#### 5.5.2.1 No Action

The no action alternative is not a remedial action technology but is evaluated as a baseline for comparison with other technologies under consideration.

#### 5.5.2.2 Monitoring and Institutional Controls

Monitoring and institutional control could be implemented in conjunction with any of the other remedial alternatives. This alternative consists of site access and use restrictions to protect human health or the environment from direct contact, ingestion or inhalation of hazardous constituents found in groundwater at the site. The groundwater monitoring would consist of periodic sampling to evaluate temporal trends in groundwater quality at monitoring wells and potential off-site migration of contaminants. Groundwater monitoring can also verify results of other remedial actions.

#### 5.5.2.3 Containment

The vertical barrier containment alternatives described in the soil remedial alternatives section are also applicable to controlling the migration of contaminants in groundwater.

#### 5.5.2.4 In Situ Biological Treatment

As described in Section 5.5.1.4, in situ biological treatment involves adding nutrients and oxygen to create an environment suitable for the biodegradation of subsurface organic contaminants.

#### 5.5.2.5 Groundwater Extraction

This alternative involves removing groundwater by pumping from extraction wells or extraction trenches. Groundwater extraction provides hydraulic control of the flow of groundwater on or off site and removes groundwater contaminants from the subsurface. Additional information necessary to evaluate this alternative includes aquifer properties which will be determined from pumping tests during the remedial investigation. This alternative, if selected, would be performed in conjunction with one of the treatment and discharge alternatives discussed herein.

#### 5.5.2.6 Groundwater Treatment and Discharge

The selection of groundwater treatment technologies will be based on the contaminants of concern and the degree of treatment required to meet discharge limitations. The on-site groundwater treatment alternatives to be considered include: no treatment, packed tower aeration for volatile compounds, activated carbon adsorption, UV oxidation, and biological treatment.

Disposal alternatives for the treated groundwater include sanitary sewer discharge, reinjection into the aquifer, storm water discharge, and a direct surface water discharge to Lake Michigan or Waukegan Harbor. Off-site treatment and disposal could be provided by discharging the groundwater to a Publicly Owned Treatment Works (POTW) or the wastewater treatment plant of an industrial facility. The choice of treatment and disposal alternatives will in large part be determined by the regulatory limits placed on the different discharge options.

Because of greater experience in industry with packed tower aeration and activated carbon adsorption, their implementability and effectiveness for site groundwater can be evaluated in detail using computer simulation models and literature values for contaminant properties. The BOD/COD, oil and grease, and suspended solids concentrations will be measured for selected groundwater samples because of the impact of these parameters on the need for

pretreatment and the feasibility of different groundwater treatment technologies.

## SECTION 6

### SCOPE OF WORK FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY

This Work Plan defines the scope of work for Remedial Investigation and Feasibility Study (RI/FS) activities at the WCP site. The draft RI/FS work plan is based on the data needs for site characterization, development of the risk assessment, and the analysis of alternatives for conceptual design of possible remedial actions. There are three supporting documents to the RI/FS work plan:

1. Field Sampling Plan (FSP) (Barr, 1991c): Provides guidance for all field work by defining the sampling and data gathering methods to be used.
2. Quality Assurance Project Plan (QAPP) (Barr, 1991b): The QAPP describes the policy, organization, functional activities and quality control protocol necessary to achieve the DQOs.

The QAPP and the FSP are included in the Sampling and Analysis Plan (SAP) (Barr, 1991a).

3. Health and Safety Plan (HSP) (Barr, 1991d): Describes procedures to be followed so that all field activities are in compliance with OSHA.

Data quality objectives and RI/FS tasks are summarized in Sections 6.1 and 6.2, respectively. The tasks included in the scope of work for the site RI/FS include a field investigation to be performed in two phases; these activities are described in Sections 6.3 and 6.4. All other tasks to be performed as part of the RI/FS are described in Sections 6.4 through 6.10.

## 6.1 DATA QUALITY OBJECTIVES

Based on the evaluation of existing data, objectives have been identified for the data type and quality needed to: characterize the site geology, hydrogeology, and soil and water quality; to identify threats to the public health and environment; and to develop and evaluate remedial action alternatives. DQOs are presented in detail in the QAPP for each component of the source/pathway/receptor model of the site and for evaluation of alternatives. DQOs are also discussed in later portions of Section 6 of this Work Plan, describing individual RI/FS tasks.

## 6.2 SUMMARY OF RI/FS TASKS

The following tasks have been identified for the WPC site RI/FS; all RI/FS efforts to be accomplished on-site are included in Task I and Task II:

### TASK I: Field Investigation - Phase I

- Subtask I.1 Investigation Support
- Subtask I.2 Preliminary Source Area Characterization
- Subtask I.3 Background Soil Sampling
- Subtask I.4 Surficial Soil Sampling
- Subtask I.5 Monitoring Well/Piezometer Installation
- Subtask I.6 Groundwater Sampling
- Subtask I.7 Ecological Survey
- Subtask I.8 Preparation of Phase I Technical Memorandum

### TASK II: Field Investigation - Phase II

- Subtask II.1 Investigation Support
- Subtask II.2 Soils Investigation
- Subtask II.3 Hydrogeologic Investigation
- Subtask II.4 Groundwater and Surface Water Sampling

### TASK III: Sample Analysis/Validation

### TASK IV: Data Evaluation

### TASK V: Risk Assessment

### TASK VI: Remedial Investigation Report

### TASK VII: Remedial Alternatives Development and Screening

TASK VIII: Alternatives Evaluation

TASK IX: Feasibility Study Report

Tasks I and II represent the two phases of the RI field investigation. Phase I activities have been designed primarily to provide preliminary screening information about source areas and groundwater conditions. The results of Phase I will then be used to focus the design of a larger, more complete Phase II investigation. The conceptual design of the phased investigation approach is introduced in the following paragraphs.

Phase I will involve investigation of the site facility foundation locations and preliminary delineation of the lateral extent of surficial soil contamination using test trenching. On-site soil samples will be collected and analyzed to provide a preliminary characterization of soil contaminants at the site. Background surficial soil samples from off-site locations will also be collected and analyzed. Phase I will also include the installation of on-site monitoring wells and piezometers to make a preliminary determination of groundwater flow directions at the site and guide the selection of further monitoring well locations and analytical parameters for Phase II. Slug tests will be performed at the Phase I monitoring wells, and groundwater samples will be collected and analyzed to provide an initial characterization of groundwater quality. Environmental sampling activities to be conducted during Phase I are summarized in Table 6.3-1. An ecological site survey will also be performed during the Phase I investigation. The Phase I findings will be presented in a Phase I Technical Memorandum to be submitted to the U.S. EPA. The ARARs and PRGs Technical Memorandum will be updated and revised to reflect the Phase I findings, and will be submitted to the U.S. EPA.

Results of the Phase I investigation will be used to refine the design of the more detailed Phase II investigation. Objectives of the Phase II investigation include: delineation of the vertical extent (and confirmation of the lateral extent) of soil contamination; characterization of site geology and stratigraphy; delineation of the extent and nature of groundwater

contamination; and characterization of the geotechnical properties of site soils. Phase II of the investigation will involve the placing of soil borings and collecting and analyzing soil samples to characterize the nature and extent of source areas identified in Phase I. A focused list of analytical parameters will be established based on the broad range of constituents addressed in Phase I testing. Additional monitoring well locations will be selected based on groundwater flow patterns and source area locations determined in Phase I; modeling will be used to help select appropriate monitoring locations. Additional slug tests and a pumping test will be conducted to assess permeability, and groundwater sampling will be performed to address groundwater quality data needs. Environmental sampling activities to be conducted during Phase II are summarized in Table 6.3-2.

### 6.3 TASK I: FIELD INVESTIGATION - PHASE I

#### 6.3.1 Subtask I.1 Investigation Support

Investigation support involves those activities which are necessary before the field activities can be implemented. Phase I investigation support activities will carry over to Phase II; preparation for both phases of investigation will be covered in this subtask.

Several of the investigation activities that will be conducted during the course of the RI will require services that will be provided by outside contractors. Services expected to be subcontracted are:

- Monitoring well construction;
- Soil boring installation;
- Laboratory analytical services;
- Laboratory geotechnical services; and
- Test trench excavation.

Barr Engineering Co. will prepare bid documents and evaluate contractor proposals covered under this subtask.

Other investigation support activities include:

- Set up of on-site facilities (including field office, storage area, and connection to utilities); and
- Negotiation with the North Shore Sanitary District, if necessary, regarding water discharge and treatment.

#### 6.3.2 Subtask I.2 Preliminary Source Area Characterization

Objectives of this task are to:

- Determine the locations of the former facility structures and foundations in order to orient additional trenches, soil borings, and monitoring wells;
- Determine visually the lateral extent of contaminated shallow soils in areas identified as potential source areas (based on knowledge of the site's operational history); and
- Enable the collection of a limited number of soil samples to be used in a preliminary characterization of site soil contaminants.

Approximately 23 test trenches (1,400 feet) will be placed at the locations shown in Figure 6.3-1. These trenches are expected to provide information on the locations of former structures and site facilities, and to provide a preliminary indication of the lateral extent of visibly contaminated soils. The locations have been selected to coincide with the locations of facility operations and potential waste placement areas (e.g., ponds) as shown in Figure 2.3-1. The test trench locations shown in Figure 6.3-1 are approximate; it is not anticipated that trenches will be excavated through and beneath remaining foundations. At least two test trenches will be excavated in the vicinity of the former creosoting facility to supplement the existing data base for this area. One of these test trenches will be excavated west of the former creosoting facility and

adjacent to the southernmost portion of the new slip and will also be used to characterize the layer of compacted coal fines found to be present along the southernmost portion of the new slip (Canonie, 1991b). Actual locations for trenching in this area will be chosen in the field because of difficulties investigating near the slip, tie-back walls, waste pile, slip excavation, soil stockpile areas, and dredge soil piles.

All trenches will be extended from areas of visible contamination to areas that appear to be clean. If contaminated zones are encountered in a test trench, an additional trench will be placed approximately perpendicular to the original trench to further delineate contaminated areas. The locations and preliminary trench lengths and orientation are shown on Figure 6.3-1. Trench depths will be extended to (and, as possible, slightly below) the water table which is expected to occur at a depth of 3 to 6 feet. Trenches will be logged and photographed as they are placed. All material excavated from the trenches will be placed back into the same trench immediately upon completion. Details of the test trenching methodology are included in the FSP.

Two former ponds, identified from aerial photographs, will be investigated as potential source areas: the first is located in the parking lot north of the former chemical lab, and the second is located in the parking lot south of the former boiler house (Figure 6.3-1). Because these areas are located in parking lots currently in use, they will be investigated with shallow soil borings (rather than trench excavations) to minimize disturbance to current operations.

Soil samples will be collected from the test trenches and shallow soil borings for examination using field screening methods. The field screening methods will include field soil classification, visual observations, field oil sheen screening, and field headspace organic vapor screening. These procedures are detailed in the FSP. The field headspace organic vapor screening will be used as an inclusive, qualitative method for assessing soil contamination; i.e., a sample that does not appear to contain chemicals of interest based on other field screening methods but shows headspace organic

vapors of greater than 100 parts per million will be included with samples selected for further investigation.

Soil samples will be selected for laboratory analysis to provide a preliminary characterization of soil quality at source areas identified by field screening methods. If distinctly different areas of contaminated soils are identified based on field screening, samples will be collected for possible laboratory analysis to characterize each potentially different contaminant type. At least one sample, visually identified as being contaminated, will be selected for analysis from each distinct area of soil contamination as determined by field observations. At least one sample will be collected from the coal fines layer found to be present along the southernmost portion of the new slip and from each of the shallow soil borings in the former pond areas. Additional samples will be selected for analysis from areas that appear to be near the limit of visible contamination and from areas that show no visible evidence of contamination.

Because the nature, extent, number, and continuity of source areas to be identified by field screening methods are currently unknown, the final number of samples to be selected for analysis cannot be projected at this time. At some trenches, more than one sample will be selected for analysis (as described above) to characterize a range of soil qualities identified by field screening. In other cases, several trenches may intersect a single continuous source area, resulting in less than one sample per trench being required to preliminarily characterize soils for that area. Other trenches that show no evidence of contamination during field screening may not have samples selected for further analysis. For planning purposes, it has been assumed that a total of 25 samples will be selected for laboratory analysis.

All samples collected for laboratory analysis will be analyzed for PAHs and VOCs. Approximately 20 percent of the samples will also be analyzed for phenols. Samples from trenches located near the thionizer building will be analyzed for cyanide and arsenic. At least one sample of soil with visible coal tar contamination and one sample of visibly contaminated soil from the area of the former creosoting facility will be analyzed for the full-scan

target compounds (i.e., semivolatiles, VOCs, cyanide, metals, and PCBs). One sample from each of the shallow soil borings in the areas of the former ponds will be analyzed for the full-scan target compounds. One sample of the compacted coal fines layer will be analyzed for the full-scan target compounds and will be assessed using the TCLP method. Sampling activities and sample selection rationale are summarized in Table 6.3-1. Details of the relevant sampling procedures are included in the FSP.

#### 6.3.3 Subtask I.3 Background Soil Sampling

Eight background soil samples will be collected from the locations shown in Figure 6.3-2. Samples will be collected from 2 to 4 feet in depth using a hand auger. Samples will be analyzed for the full-scan target compounds. Objectives of the background sampling are to (1) characterize typical local background concentrations of chemical constituents in soils in the surrounding industrial area, and (2) characterize typical background concentrations of chemical constituents in soils in local areas thought to be unaffected by industrial activities. Details of the background soil sampling are in the FSP.

#### 6.3.4 Subtask I.4 Surficial Soil Sampling

In order to characterize surficial soil quality across the site, a series of 17 shallow soil samples will be collected at the locations shown in Figure 6.3-3. The locations were selected to address portions of the site where potential source areas have not been identified and where other sampling efforts have not been completed. Where possible, a test pit will be excavated with a backhoe to provide visual information at the selected locations. Based on that visual information, sampling points adjacent to the test pits will be selected. At each of these sampling points, a sample will be collected from 2 to 4 feet in depth using a hand auger. Shallow soil borings will be used for sample collection at the three locations in the OMC Plant No. 1 parking lot (Figure 6.3-3). Each sample will be analyzed for the full-scan of target compounds. Details of the surficial soil sampling activities are included in the FSP.

#### 6.3.5 Subtask I.5 Pilot Borings/Monitoring Wells

Eight monitoring wells and four piezometers will be installed at the site as part of the Phase I investigation. Proposed locations of the wells are shown in Figure 6.3-4. At each monitoring well location, a pilot boring will be installed to direct placement of the well screens of the monitoring wells.

##### 6.3.5.1 Pilot Borings

The pilot borings will be placed at the deep well locations shown in Figure 6.3-4. These borings are intended to provide preliminary information on the subsurface stratigraphy (to confirm or revise the conceptual model of the site) and to aid in determining the depth at which monitoring wells will be screened. Additional borings will be placed in Phase II to more fully characterize the extent of any discrete areas of contamination identified in Phase I, and to more fully characterize site geology.

Phase I pilot borings will be advanced to the top of the gray silt and clay till anticipated to occur at a depth approximately 25 to 30 feet below ground surface. Geotechnical borings will be advanced using 3½ or 6½-inch (I.D.) hollow-stem auger drilling techniques. Where practical, monitoring wells will be installed into the pilot boring boreholes. One pilot boring will be advanced through the till to bedrock. It is expected that the pilot boring for Well W-3D will extend to bedrock.

All borings will be sampled at 2½-foot intervals, using a standard split spoon sampler following ASTM Standard D1586 for the Standard Penetration Resistance Test. Special effort will be used to collect split-spoon samples at the till-sand interface and at other changes in stratigraphy. Except in cases when a well is installed into the borehole, boreholes will be abandoned with neat cement grout following completion.

Each boring will be logged by an experienced geologist. Soil samples will be classified according to ASTM D2488-Procedure for Classification and

Identification of Soils (Visual-Manual Procedure). Additionally, each sample interval will be screened for volatile organic compounds (VOCs) using a field headspace screening method (FSP, Barr 1991c).

Representative soil samples from the pilot borings will be collected for laboratory analysis if areas showing significant visual evidence of contamination are encountered or if headspace screening indicates that the sample contains elevated concentrations of VOCs (see Section 6.4.2.2 - Field and Laboratory VOCs). These samples will be analyzed for PAHs and VOCs.

All boring elevations and locations will be surveyed relative to a common datum. The stratigraphic information collected will also be used to make a preliminary characterization of the site geology and stratigraphy to identify potential migration pathways and evaluate the fate and transport of released contaminants. Additional information on soil boring placement procedures are presented in the FSP (Barr, 1991c).

#### 6.3.5.2 Monitoring Well/Piezometer Installation

To make a preliminary characterization of groundwater quality and flow directions at the site, eight monitoring wells and four piezometers will be installed as part of the Phase I investigation. The proposed locations are shown in Figure 6.3-4.

Water table Wells MW-3S, MW-4S, MW-5S, and MW-6S will be placed along the northern, eastern, southeastern and western boundaries of the site, respectively. Piezometers P-101 and P-102 will be placed in the northwestern and northeastern corners of the site, respectively. Piezometers P-103 and P-104 will be placed near the center of the site, east of existing Wells MW-1S and MW-1D. Monitoring Wells MW-3S and MW-3D and Piezometers P-103 and P-104 are located to provide data for defining the groundwater divide that is expected to occur near the center of the site. Additionally, Wells MW-3S and MW-3D may be located in a location upgradient of the site (Geraghty and Miller, 1990). The perimeter monitoring wells are positioned to act as monitoring points at the site boundaries and, in conjunction with the

piezometers, to provide site-wide coverage for groundwater elevation measurements.

Wells MW-3S, MW-4S, MW-5S, and MW-6S will be nested with deeper Monitoring Wells MW-3D, MW-4D, MW-5D and MW-6D. The deeper wells will be screened in the interval just above the till at elevations similar to the existing deep monitoring wells. These wells will provide vertical hydraulic gradient information and will give a preliminary indication of groundwater quality and flow directions at the base of the surficial sand unit.

Monitoring wells will be constructed in accordance with the Illinois Water Well Construction Code (Chapter I, Subpart 920). Risers will be constructed of 2-inch nominal diameter stainless-steel casing. The water table wells will have 10-foot long stainless-steel screens and the deeper wells will have 5-foot long stainless steel screens. The water table wells are designed with longer screens so that groundwater levels in the wells will remain within the screened intervals even with seasonal fluctuations in the elevation of the water table. The deeper wells will utilize 5-foot long screens because they are not designed to intersect the water table and can therefore monitor a more distinct groundwater interval.

Well installation will be performed using hollow-stem auger drilling equipment. Well construction methods for the water table wells will be designed to account for the limited distance that is anticipated between ground surface and the top of the screen. Details of the monitoring well construction are included in the FSP.

Piezometer construction will be similar to construction of the water table monitoring wells with the exception that the risers and screens will be 1-inch diameter PVC.

#### 6.3.5.3 Survey

The elevations at the top of the casing and the ground level at each existing and newly installed monitoring well and piezometer will be surveyed and tied into a common mean sea level datum. The well locations will also be tied into a site orthogonal coordinate system. Control points will be established on-site to facilitate future surveys.

#### 6.3.5.4 Water Level Measurements

Water levels will be measured in the Phase I monitoring wells and piezometers to provide information on hydraulic gradients and groundwater flow directions. This information will be used to develop a preliminary model of groundwater flow at the site.

#### 6.3.5.5 Permeability Testing

Slug tests will be conducted at the Phase I monitoring wells to assess the horizontal hydraulic conductivity of the sand unit. Hydraulic conductivity testing methodologies are described in Section 3.10 of the FSP.

#### 6.3.6 Subtask I.6 Groundwater Sampling

During Phase I investigations, groundwater samples will be collected from the eight newly-installed monitoring wells and the two wells currently present at the WCP site. These samples will be analyzed for the full-scan target compound list (i.e., semivolatiles, VOCs, cyanide, metals, and PCBs). Sampling procedures are detailed in the FSP.

#### 6.3.7 Subtask I.7 Ecological Survey

An ecological survey of the site and the surrounding area will be conducted as part of the Phase I field investigation. The purpose of the survey is to identify and characterize terrestrial and aquatic habitats on and near the work site. The scope of the survey will include the

identification of rare or significant habitat features, wetlands, floodplains, common plant and animal species, and known rare or endangered species.

In preparation of this ecological survey, previous ecological studies will be reviewed for information regarding plant and animal species and habitat. Available sediment and surface water data will also be reviewed. State and local natural resources agencies will be contacted and requested to provide all available historical and up-to-date information about the ecology of the study area. Site reconnaissance will be conducted to characterize the existing condition of the study area. A map will be developed for this site which will note pertinent ecological features. All of the above information will be evaluated and summarized and included in the Phase I Technical Memorandum.

#### 6.3.8 Subtask I.8 Preparation of Phase I Technical Memorandum

Once Phase I RI tasks are completed, a Phase I Technical Memorandum will be prepared that summarizes the data collected. Locations for Phase II activities will be proposed. It is expected that the Phase I Technical Memorandum will be submitted to EPA after the completion of Phase I activities and within 60 days of the receipt of all data from samples sent to the analytical laboratory. The Phase I Technical Memorandum will include:

- Test trench logs
- Pilot boring logs
- Monitoring well/piezometer construction logs
- Site data (water levels, soil quality, groundwater quality, as available)
- Results of groundwater flow modeling

- A summary of available information from ecological studies of areas near the site and their relevance to potential surface water or sediment sampling in Phase I.

#### 6.4 TASK II: FIELD INVESTIGATION - PHASE II

As noted above, once Phase I is completed, a technical memorandum will be prepared summarizing the details of the Phase I Investigation Work Plan. The Phase Technical Memorandum will include the proposed sampling locations for the Phase I soil boring investigation, hydrogeologic investigation, and groundwater quality investigation. Phase II of the field investigation is projected to begin following EPA approval of the Phase Technical Memorandum. The following is a description of the Phase I tasks that will be conducted; more detailed information (for example, the number and locations of soil borings, monitoring wells, or geotechnical samples) will be included in the Phase Technical Memorandum.

The objectives of the Phase I investigation are to:

1. Provide additional information on the lateral extent of soil contamination identified in Phase .
2. Characterize the vertical extent of soil contamination in areas identified as contaminated in Phase .
3. Characterize site geology and stratigraphy.
4. Evaluate hydraulic characteristics of the sand unit.
5. Assess site groundwater quality downgradient of identified source areas.
6. Characterize the site's groundwater flow regime.

7. Characterize the geotechnical properties of the till and sand units for use in the development of remedial alternatives.
8. Provide data needed to evaluate potential treatment technologies for remedial alternatives.

The Phase II investigation will involve placement of soil borings, sampling and analysis of soils for contaminants, sampling and analysis of soils for geotechnical parameters, installation of additional monitoring wells, permeability testing, and groundwater sampling and analysis. Phase II environmental sampling activities are summarized in Table 6.3-2.

#### 6.4.1 Subtask II.1: Investigation Support

Investigation support activities for both Phase and Phase I of the field investigation are described in Section 6.3.1.

#### 6.4.2 Subtask II.2: Soils Investigation

##### 6.4.2.1 Soil Borings

Soil borings will be placed in areas identified in Phase that contain surficial soil contamination to evaluate the vertical and horizontal extent of contamination. Additional borings will be placed in areas to fully delineate site stratigraphy, to serve as pilot borings for monitoring wells, and to confirm the delineated horizontal and vertical extent of subsurface soil contamination. Soil borings will generally be advanced to the top of the gray silt and clay till anticipated to occur at depths approximately 25 to 30 feet below ground surface. Following a complete evaluation of Phase I data, in conjunction with data available from prior investigations, additional soil borings may be placed in Phase II in the vicinity of the former creosoting facility to address data gaps identified for this area of the site.

Based on the types and locations of the various former facilities at the site (shown in Figure 2.3-1), it is anticipated that four to eight separate areas may be identified in Phase I for further investigation. During Phase II, the vertical and horizontal extent of soil contamination in each area will be characterized with two to six soil borings, depending upon the Phase I results and the size of the area. The borings will be placed in each identified area according to the following rationale:

- One boring placed in the zone identified as highly contaminated based on Phase I results (two borings may be placed for areas of greater extent);
- One boring placed in the zone identified as intermediate in contamination (or at the fringe of contamination) based on Phase I results (two borings may be placed for areas of greater extent); and
- One boring placed outside the limit of contamination identified from Phase I results (no borings may be required for areas surrounded by other investigated zones; two borings may be required for more isolated areas).

Based on the assumptions presented above, it is anticipated that approximately 40 soil borings will be placed during Phase II. If no significant contamination is observed during Phase I, or if conditions are significantly different from those anticipated, the rationale for locating soil borings will be reviewed. The locations of soil borings for Phase II will be proposed in the Phase I Technical Memorandum.

Geotechnical borings will be advanced using 3½ or 6½-inch (I.D.) hollow-stem auger drilling techniques. All borings will be sampled at 2½-foot intervals, using a standard split spoon sampler following ASTM Standard D1586 for the Standard Penetration Resistance Test. Except when a well is installed into the borehole, boreholes will be abandoned with neat cement grout following completion.

Each boring will be logged by an experienced geologist. Soil samples will be classified according to ASTM D2488 Procedure for Classification and Identification of Soils (Visual-Manual Procedure). Additionally, each sample interval will be screened for volatile organic compounds (VOCs) using a field headspace screening method and visually inspected for MGP wastes (FSP, Barr 1991c).

All boring elevations and locations will be surveyed relative to a common sea level datum. The stratigraphic information collected will be used to characterize the site geology and stratigraphy, to identify potential migration pathways, and to evaluate the fate and transport of released contaminants. Additional information on soil boring placement is presented in the FSP (Barr, 1991c).

#### 6.4.2.2 Soil Sampling

The soil sample collection objectives are:

- To characterize the nature and extent of chemical constituents (defined from Phase I results) which are present in soils from the ground surface to the base of the surficial sand unit and in the clay till unit, if necessary.
- To determine the stratigraphy of the fill, surficial sand unit, and clay till.
- To obtain representative samples with which to determine engineering properties and characteristics that will direct remedial alternatives screening, including: grain size distributions, Atterberg limits, porosity, and total organic carbon content of the surficial sand unit and clay till unit; and to determine the vertical permeability of the clay till. Additional samples will be collected for: TCLP; gross heating value (Btu/lb.); and flashpoint.

Soil samples will be collected for the tests according to the schedule described below.

- Field Soil Classification: All samples from all borings.
- Field Screening: All samples from all borings (see FSP).
- Field pH: All samples from all borings (see FSP).
- Laboratory PAH: Because wastes containing PAHs may have been placed at or near the present ground surface elevation, one near-surface soil sample from each soil boring will be selected for laboratory analysis. The specific depth intervals for the near-surface samples will be determined based on Phase I information about site stratigraphy and soil contamination, and on depth-specific data needs that may be identified for completing the Risk Assessment. In addition, because coal tar and creosote may migrate as dense, nonaqueous phase liquids, one sample from near the contact between the sand unit and the till will be analyzed for PAHs from each boring. Additional samples from the interval between the near-surface sample and the sand/till contact sample will be collected for laboratory analysis as necessary to characterize the vertical extent of contamination. Sample selection will be based on field screening results and stratigraphic controls that may be identified. It is assumed that an average of 3.5 samples from each soil boring will be submitted for laboratory analysis of PAHs.
- Phenols: Approximately 20 percent of the soil samples analyzed for PAHs will also be analyzed for phenolic compounds. The data will be used to characterize the subsurface distribution of phenols; a smaller number of samples will be collected than for PAH analyses because: (1) phenols are less likely to govern site remediation due to generally lower toxicity and higher regulatory standards than for carcinogenic PAHs; and (2) phenols are generally more

mobile than many of the PAHs and therefore will be detected in the groundwater sampling and analysis program if present in soils at levels of concern. Possible correlations between PAH and phenol concentrations in soil samples will be assessed to aid in data interpretation.

- Cyanide and Arsenic: Soil samples from borings located near the thionizer building/sulfur pile will be analyzed for cyanide and arsenic. Additional analysis for these constituents may be performed if Phase I results indicate other areas of cyanide and arsenic contamination.
- Corrosivity and Reactivity: Soil samples from borings located near the thionizer building/sulfur pile will be analyzed for corrosivity and reactivity.
- Field and Laboratory VOCs (BETX): Soil samples will be screened for total VOCs using a field headspace procedure (as described in Attachment 4 of the FSP). Field testing for VOCs measures the total volatile organics in the headspace above a sample which has been broken up inside a jar to free the VOCs. Beginning at a depth of 2.5 feet, all samples taken from borings will be screened in the field for VOCs. Samples selected for laboratory analysis of PAHs will also be submitted for laboratory analysis of BETX. If the total VOCs measured with the field screening procedure exceeds 100 ppm in a sample apparently not containing PAHs, then the next interval down may be sampled for laboratory analysis of VOCs. This method of alternating samples is used for VOCs to minimize opportunity for volatilization from the sample during the sample collection process. Samples will be collected using brass tube liners (see FSP).
- Other Chemical Constituents of Concern: If the Phase I analyses of soil and groundwater samples for a broad range of parameters indicates additional chemical constituents require investigation,

such chemicals will be addressed in Phase II. Any such parameters will be identified in the Phase I Technical Memorandum.

- Grain Size Distribution: Three samples of surficial sand and three samples of the clay till will be selected to be representative of the hydrostratigraphic units based on the results of the soil classification and to provide areal representation of the site. Additional samples will be submitted as necessary to characterize variations within the hydrostratigraphic units.
- Atterberg Limits: Three samples of the clay till; tests to be completed on splits of the samples submitted for grain size distribution analysis. Samples of the fill will also be tested for Atterberg limits, if appropriate.
- Porosity: Three samples of the surficial sand unit and three samples of the clay till, selected to be representative of the hydrostratigraphic units based on the results of the soil classification and to provide areal representation of the site.
- Total Organic Carbon: Three samples of the clay till unit and three samples of the surficial sand unit selected based on the results of the soil classification to be representative of the units and to provide areal representation of the site. These samples will not be collected from visibly contaminated areas.
- Vertical Permeability: Three samples of the clay till unit will be selected. They will be selected to be representative of the unit and to give areal representation of the site.
- TCLP: Approximately three samples from potentially contaminated areas.
- Gross Heating Value (BTU/lb): One sample to be collected at each location sampled for TCLP.

- Flashpoint: One sample to be collected at each location sampled for TCLP.

#### 6.4.2.3 Soil Sampling Equipment and Procedures

Samples to be analyzed for permeability will be collected with a Shelby tube sampler in accordance with ASTM D-1587. Samples to be submitted for laboratory analysis of VOCs will be collected using brass tube liners (see FSP for procedures). All other samples will be obtained with a split barrel sampler in accordance with the procedures outlined in the FSP. Upon retrieval of each split barrel, the soils will be classified, visually inspected for coal tar contamination, and screened for field VOCs. The sample will be placed in a clean, airtight glass jar. Upon completion of each boring, samples will be selected for laboratory analysis of PAHs and other low volatility compounds.

#### 6.4.3 Subtask II.3 Hydrogeologic Investigation

##### 6.4.3.1 Monitoring Well Installation

In addition to the eight new monitoring wells and four piezometers that will be installed as part of the Phase I investigation, supplemental monitoring wells will be installed, as necessary, downgradient of areas of soil contamination identified in the Phase I and Phase II investigations. Upgradient wells may also be installed if appropriate. Groundwater flow patterns will be examined to determine appropriate locations for Phase II wells. Groundwater flow patterns will be evaluated based on models developed using the SLAEM code (Strack, 1990) and relevant Phase I data; proposed groundwater modeling methodology is described in the Groundwater Modeling Technical Memorandum. Phase II monitoring wells will be located in areas that will: (1) provide groundwater quality information to address identified data gaps; (2) complete the characterization of site groundwater flow patterns; and (3) provide for pumping and slug test permeability characterization.

The Phase II monitoring wells will be placed so that their screens are at approximately the same stratigraphic horizon as the screens of the existing wells (MW1S and MW1D) and Phase I wells (MW3S through MW6S and MW3D through MW6D). The need for wells screened at different intervals will be evaluated once the results of Phase I and the Phase II soil borings are completed.

The monitoring wells will be constructed in accordance with the Illinois Water Well Construction Code (Chapter I, Subpart 920). Risers will generally be constructed of 2-inch nominal diameter stainless steel casing with 10-foot long stainless steel screens. Well installation will utilize hollow-stem auger techniques. Where possible, monitoring wells will be installed into pilot boring boreholes.

A 4-inch diameter well will be installed at the site for use as a pumping well during the pumping test (see below). The location of this well will be chosen after the completion of Phase I investigations and the Phase II soil borings. Installation techniques and materials will be similar to the other Phase I and Phase II monitoring wells, with the exception that the well will be 4 inches in diameter. The 4-inch well will also be used as a monitoring well.

#### 6.4.3.2 Survey

The elevations of the top of the casing (TOC) and of the ground level at each existing and newly installed monitoring well be surveyed and tied into a common mean-sea-level datum. The well locations will also be tied into a site orthogonal coordinate system.

#### 6.4.3.3 Water Level Measurements

**Discrete Measurements:** Groundwater elevations will be measured approximately on a quarterly basis to provide at least three measurement dates for inclusion in the draft RI report. If other nearby private wells are found during the RI, water levels will also be measured in the private

wells in order to fully delineate the area-wide groundwater flow regime. The surface water elevation in Waukegan Harbor will also be measured. Groundwater flow directions and gradients will be determined from the water level information.

Continuous Measurements: Water levels will be measured continuously in two of the water table monitoring wells and one of the deeper wells for approximately one week. The data collected will be used to assess the relationships among groundwater elevations, surface water levels, and recharge events. An electronic data logger and a sensitive pressure transducer will be used to record the water level elevation every 10 minutes during the continuous water level measurement period. Precipitation data will be obtained from the local weather service or possibly from on-site measurements.

#### 6.4.3.4 Permeability Testing

During Phase II investigations, slug tests will be conducted in all of the newly installed monitoring wells to estimate the horizontal hydraulic conductivity of the surficial sand unit.

A modified triaxial permeability test will be conducted on at least three samples of the upper portion of the clay till unit to determine the vertical permeability of the till unit. The triaxial permeability test involves placing an undisturbed soil sample under a confining pressure to represent natural conditions. The test is then run using standard falling head permeability test procedures for fine-grained soils.

A 24-hour pumping test will be conducted in the 4-inch diameter monitoring well. Pumping test design will be guided by the available slug test results. During the pumping test, continuous water levels will be measured in at least two water table monitoring wells and at least two deeper monitoring wells. Discrete water levels will be measured in other on-site wells. A 24-hour pumping test is proposed in order to minimize the production of potentially contaminated groundwater. The pumping well will be

designed and situated so that monitoring wells are positioned close enough for meaningful water level data to be collected during the test. The pumping test design will be proposed in the Phase I Technical Memorandum. The design will be based on results of the Phase I groundwater sampling and analyses, water level measurements, soil borings, and hydraulic conductivity testing (slug tests).

An effort will be made to conduct the pumping testing in an area where groundwater contamination is minimal. However, a determination of appropriate disposal practices for the pumped water will be made following a review of groundwater quality data. Results of the pumping test will be used to estimate the hydraulic conductivity of the surficial sand unit.

#### 6.4.4 Groundwater and Ecological Sampling

Objectives of this subtask are to:

- Determine the nature and extent of contamination downgradient of source areas identified in the soils investigation;
- Evaluate the spatial distribution of contaminants in groundwater;
- Collect sufficient data to determine whether or not the site poses a threat to potential downgradient receptors (i.e., the environment and drinking water wells); and
- Assist in selection of possible remedial alternatives.

To accomplish these objectives, samples will be collected from both newly installed and existing monitoring wells .

#### 6.4.4.1 Groundwater Sampling

Two groundwater sampling events are proposed for Phase II. The first sampling event will take place within approximately one month of the completion of proposed monitoring wells. During the first sampling event, water quality samples will be collected from each monitoring well installed during Phase II investigations. A second sampling event will be scheduled at least one month after the first. During the second sampling event, samples will be collected from all site monitoring wells to provide one site-wide set of contemporaneous groundwater quality data. It is anticipated that groundwater samples will be analyzed for PAHs, phenols, and BETX. The necessary data quality (i.e, detection levels) for PAH analyses will be selected based on prior sampling results. If relatively high concentrations of compounds are detected in samples from specific wells, the second round of samples from these wells will also be analyzed for BOD/COD, oil and grease, and total suspended solids to help evaluate potential treatment alternatives. Details of groundwater sampling protocols are included in the FSP (Barr, 1991c) and in the QAPP (Barr, 1991b).

#### 6.4.4.2 Ecological Sampling

If the hydrogeologic investigation identifies contaminated groundwater moving off site and discharging to surface waters, samples may be collected from Lake Michigan and/or Waukegan Harbor as appropriate for evaluation of the human or ecological risk assessment as needed. Further biological analysis may or may not be needed depending on the results of Phase I Technical Memorandum identification of likely contaminants of concern, indigenous plant and animal species present, likelihood for the contaminant to affect those species, and other pertinent data identified in the Phase I Ecological Survey. Sampling procedures and analytical parameters will be defined in the Phase II investigation work plan.

#### 6.5 TASK III: SAMPLE ANALYSIS/VALIDATION

Soil and groundwater quality sample analyses (performed at the analytical laboratory) and data validation will be conducted using the procedures described in the QAPP (Barr, 1991b).

#### 6.6 TASK IV: DATA EVALUATION

A Preliminary Site Characterization Summary will be prepared shortly after all RI data are received. The summary will provide a transmission of RI data before the data evaluations are completed. Subsequently, evaluations of RI and relevant pre-RI data will be completed. Validated data will be entered into a site data base system. Plots, contours, and maps will be developed to assist in data explanation and presentations. All RI objectives will be reviewed to determine if the gathered data provides the specific information required by each task. Limitations will be identified and documented in the RI Report.

It is anticipated that revisions to the Phase I groundwater flow modeling will be performed to: (1) refine estimates of hydrogeologic parameters and groundwater flow directions; (2) identify contaminant migration pathways in groundwater for assessing exposure scenarios; (3) quantify groundwater discharge rates to surface waters from different areas of the site; and (4) establish a framework for evaluating groundwater remedial alternatives. We propose to use the Single Layer Analytic Element Model (SLAEM) to simulate groundwater flow (Strack, 1990). Groundwater contaminant transport simulations will be performed using the MYGRT Version 2.0 code (EPRI, 1989) to predict environmental fate and transport. The proposed modeling is detailed in the Groundwater Modeling Technical Memorandum, submitted concurrent with the submittal of this Work Plan.

## 6.7 TASK V: RISK ASSESSMENT

A baseline risk assessment will be performed to provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action. The risk assessment will have two components, a human health and an environmental evaluation.

The human health evaluation is an analysis of the potential adverse health effect caused by hazardous substances releases from a site in the absence of any action to control or mitigate these releases. The baseline human health evaluation will consist of collected and evaluated data, exposure assessment, toxicity assessment and risk characterization.

The environmental evaluation will be a qualitative or quantitative appraisal of the actual or potential effects of waste constituents on plants and animals other than humans and domesticated species.

The baseline risk assessment will be performed consistent with guidance presented in: Risk Assessment Guidance for Superfund - Volume I; Human Health Evaluation Manual (Part A) (U.S. EPA 1989); and Risk Assessment Guidance for Superfund - Volume II - Environmental Evaluation Manual.

The formal baseline risk assessment will be performed by U.S. EPA Region V.

## 6.8 TASK VI: REMEDIAL INVESTIGATION REPORT

A draft report summarizing RI activities and findings will be prepared and submitted to the EPA for review and comment. Following this review, a meeting will be held with EPA staff to clarify concerns and required changes. The changes will be made and the final RI will then be submitted to the EPA.

Information on the field investigation activities and analytical data will be submitted to the EPA and Illinois EPA as early as possible to aid in

identification of ARARs and to provide U.S. EPA's risk assessment contractor with the data to assist in their health assessment of the site.

#### 6.9 TASK VII: REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

Following completion of the RI, the preliminary remedial action objectives will be reassessed, general response actions listed, and remedial technologies identified and screened. The screening will be based on technical implementability. Summary lists of both applicable and inapplicable remedial technologies and explanations for the rejection of the inapplicable technologies will be provided in the Technologies and Screening Process Technical Memorandum.

Using the remaining general response actions and technologies, alternatives will be developed. Emphasis will be placed on treatment alternatives which reduce toxicity, mobility, or volume of contaminated media. A list of alternatives ranging from permanent, low maintenance, or management solutions to less permanent solutions requiring more long-term management will be developed. Innovative technologies having the potential for better treatment performance, implementability, or lesser adverse effects than other available approaches will be carried through the screening process. At this point, a meeting will be held with the EPA staff to ensure that the alternatives are appropriate and complete. Following the meeting, a technical memorandum summarizing the screened alternatives and proposed ARARs will be submitted to EPA.

Developed alternatives will be screened using criteria of effectiveness, implementability, and cost. Results will be submitted to EPA in the Alternatives Array Summary Technical Memorandum. Cost will be used to discriminate between treatment alternatives that provide similar levels of protection but will not be used as a criterion for comparing treatment to nontreatment alternatives. The potential need for treatability studies will be addressed in the Treatability Study Technical Memorandum.

#### 6.10 TASK VIII: ALTERNATIVES EVALUATION

The purpose of this task is to perform a detailed analysis of those alternatives that passed through the screening process. These remaining alternatives will be analyzed in greater detail with the criteria of short-term effectiveness, long-term effectiveness, reduction of toxicity, mobility or volume, implementability, cost, compliance with ARARs, and overall protection of human health and the environment.

Costing of alternatives will include a present worth cost analysis. The capital and operation and maintenance cost estimates and are expected to be accurate within a range of plus 50 percent and minus 30 percent. A matrix table presenting the analysis of the criteria for each alternative will be developed. A conceptual design for the recommended alternatives will be generated.

#### 6.11 TASK IX: FEASIBILITY STUDY REPORT

An agency review draft FS report summarizing the results of the feasibility study will be prepared. Copies of the draft report will be submitted to the EPA for review. Following EPA review, a meeting will be held to discuss and clarify EPA's comments. Changes to the report will be made following this meeting and the final report will be submitted to the EPA.

#### 6.12 PROJECT MANAGEMENT

##### 6.12.1 Site Management

The WCP site is owned by OMC. Site access approval will need to be obtained from OMC prior to entry for RI/FS activities. Access approval will be coordinated with the EPA. The EPA will, in any case, be notified two weeks prior to scheduled site activities and as soon as possible prior to any unscheduled activities that may be necessary.

#### 6.12.2 Data Management

All site data will be managed in accordance with the protocols defined in the QAPP. A computerized data base will be established to handle the input/output requirements associated with the analytical data. The data base file will be established as a random access file with a structure comparable to the analytical data. Data base and spreadsheet software to be used will be compatible with industry standard formats. All input will be subject to a network of security, privacy, manual data validation and computerized error checking procedures. Data outputs will consist of standardized data tables and graphics. Scheduled data back ups will be made and stored both on- and off-site.

#### 6.12.3 Schedule

A proposed project schedule is presented by duration of tasks in Table 6.12-1 and by timeline in Table 6.12-2. The schedules include the RI/FS tasks identified above and deliverables noted in the Administrative Order on Consent.

## REFERENCES

- American Wood-Preservers Association, 1988, Book of Standards, Bethesda, MD.
- Barr, 1990, Site Background Technical Memorandum. Waukegan Coke Plant Site, Waukegan, Illinois. Prepared for North Shore Gas Company.
- Barr, 1991a, Sampling and Analysis Plan (SAP). Waukegan Coke Plant Site, Waukegan, Illinois. Prepared for North Shore Gas Company.
- Barr, 1991b, Quality Assurance Project Plan (QAPP). In Sampling and Analysis Plan, Waukegan Coke Plant Site, Waukegan, Illinois. Prepared for North Shore Gas Company.
- Barr 1991c, Field Sampling Plan (FSP). In Sampling and Analysis Plan, Waukegan Coke Plant Site, Waukegan, Illinois. Prepared for North Shore Gas Company.
- Barr, 1991d, Health and Safety Plan (HSP). Waukegan Coke Plant Site, Waukegan, Illinois. Prepared for North Shore Gas Company.
- Baehr Organization, 1927. Test Hole Plan Sheets, Sheet No. B-1527, June 1927.
- CH<sub>2</sub>M Hill, 1983 Source Control Feasibility Study: OMC Hazardous Waste Site, Waukegan, Illinois, July 14, 1983.
- Canonie Environmental, Inc., 1989. Design and Analysis Report, Prepared for OMC.
- Canonie Environmental, Inc., 1990a. Draft Data Summary Report - New Slip Soil Investigation, March 1990.
- Canonie Environmental, Inc., 1990b. Revised Appendix M and Appendix N, Design and Analysis Report, October 1990. Prepared for OMC.
- Canonie Environmental, Inc., 1991a. Preliminary Data Package provided by U.S. EPA; includes Plan View of New Slip Area (March 18, 1991 cover letter from OMC), Information from "Area A" Soils Investigation (March 14, 1991 cover letter from OMC), Summary of Analytical Results (February 12, 1991 fax from Canonie), and Preliminary Analytical Results (December 12, 1990 cover letter from Canonie).
- Canonie Environmental, Inc., 1991b. Data Report, Soil and Water Test Results, November 1990 to June 1991, New Slip Area, Waukegan Harbor Superfund Site, Waukegan, Illinois, Prepared for Waukegan Harbor Trust, August 1991.
- Chicago Title Insurance Company, 1991. Tract Index Search No. TS315-042V, June 7, 1991.

#### REFERENCES (Cont.)

- City of Waukegan, 1988. Zoning Ordinance, Official Zoning Map, and Comprehensive Plan. June 6, 1988.
- Duff & Phelps, 1940. Report on North Shore Gas Company and North Shore Coke and Chemical Company.
- Electric Research Power Institute (EPRI) 1989. MYGRT Code Version 2.0: An Ibm Code for Simulating Migration of Organic and Inorganic Chemicals in Groundwater, Report EN-6531, Palo Alto, CA.
- Elgin, Joliet, and Eastern Railway, 1990. 104(e) Information Response, January, 1990.
- Factory Insurance Association, 1955. Map of General Motors Corporation, Chevrolet Division Grey Iron Foundry, May 27, 1955.
- Fisher, C.H., 1938. Composition of Coal Tar and Light Oil. Bureau of Mines Bulletin, 412. Washington, D.C.
- Gas Research Institute (GRI), 1987. Management of Manufactured Gas Plant Sites, Volume I: Wastes and Chemicals of Interest, October 1987.
- General Motors, 1990. 104(e) Information Response, January 1990.
- Geraghty and Miller (G&M), Inc., 1990. Risk Assessment for New Slip Construction, Waukegan Harbor, Illinois.
- Hey and Philippi, Editors, Undated. The Des Plaines River Wetlands Demonstration Project, Volume II, Baseline Survey, Wetlands Research, Inc.
- Hughes, G.M., P. Kraatz, and R. Landon, 1966. Bedrock Aquifers of Northeastern Illinois, Illinois State Geological Survey, Circular 406.
- Illinois Environmental Protection Agency (IEPA), 1989. Facsimile dated 9/8/89 from Ken Corkill (EPA) to Al Hanson of Outboard Marine Corporation.
- Illinois Environmental Protection Agency (IEPA), undated. Undated Report: CERCLA Screening Site Inspection Report, GM Coke Plant, ILD980993570.
- JRB and Associates, Inc., 1981. Technical and Witnessing Case Support; Hydrogeological Study of Groundwater - Final Report, Prepared for OMC.
- Lineback, J.A., 1979. Quaternary Deposits of Illinois, Illinois Geological Survey.

REFERENCES (Cont.)

- Lorenz, L.F., and L.R. Gjovik. 1972. Analyzing Creosote by Gas Chromatography: Relationship to Creosote Specifications. Proc., Am. Wood-Pres. Assoc. 68:32-41.
- Martin, S.W., 1949. Characterization of Creosote Oil. Proc. Am. Wood-Pres. Assoc. 45:100-163.
- North Shore Gas Company, 1990, 104(e) Information Response, January 1990.
- North Shore Gas Company, 1947. Annual Report
- Outboard Marine Corporation (OMC), 1972. Specifications for the Dismantling of Coke Oven Plant at Sea Horse Drive, Waukegan, Illinois, February 7, 1972.
- Outboard Marine Corporation, 1990. 104(e) Information Response, January 1990.
- Real Estate Research Corporation, 1971. Appraisal of the Chevrolet Coke Plant-Waukegan, Illinois, May 1971.
- Reinertsen, D.L., A.N. Hansel and R.D. Norby, 1981. A Guide to the Geology of the Zion-Lake Bluff Area, Illinois State Geological Survey Field Trip Guide Leaflet 1981C.
- Sanborn Fire Insurance Maps, 1917 and 1929, Waukegan, Illinois.
- Shreve, R.N., 1945. The Chemical Process Industries. McGraw-Hill Book Co., Inc., New York, New York.
- Strack, O.D.L., 1990. SLAEM - Single Layer Analytic Element Model Version V.2.1, O.D.L. Strack, University of Minnesota.
- United States Army Corps of Engineers, 1908. Map of Waukegan Harbor, Illinois.
- United States Department of Agriculture Soil Conservation Service, 1970. Soil Survey, Lake County, Illinois.
- Willman, H.B., et al., 1967. Geologic Map of Illinois, Illinois State Geological Survey.

# Tables

TABLE 2.2-1  
TITLE SEARCH INFORMATION

GRANTOR	GRANTEE	DATE OF DEED	RECORDED
Charles H. Coster & WF	E.J. & E. Railway Company	7/14/1893	7/18/1893
E.J. & E. Railway Company	William A. Baehr	3/14/27	3/16/27
William A. Baehr	North Shore Coke & Chemical Co.	3/14/27	3/16/27
North Shore Coke & Chemical Co.	North Shore Gas Co. Corp.	12/23/41	12/23/41
North Shore Gas Co. Corp.	Waukegan Coke Corp.	6/28/47	7/14/47
Waukegan Coke Corp.	General Motors Corp.	5/28/48	6/03/48
General Motors Corp.	Outboard Marine Corp.	11/08/71	8/28/72

TABLE 2.3-1

INVENTORY OF STRUCTURES/EQUIPMENT AT THE WCP SITE<sup>a, b</sup>Coal Preparation Area

Coal screening towers (2)  
 Coal mixing tower  
 Coal crushing tower  
 Various conveyor belts  
 Boat unloading tower

By-products Area

By-products building  
 Tar storage tanks  
 Fuel oil tank  
 Ammonia tank  
 Ammonia cooling coils  
 Acid storage tank  
 Hot flush tank  
 Fuel gas holder  
 Still waste liquid sump  
 Naphthalene sump  
 Naphthalene oil pump  
 Cooling tower  
 Scrubbing tower  
 Gas oil tanks (2)

Purification Area

Thionizer Absorber/Regenerator

Oven Area

31 Koppers Co. Becker Type Ovens  
 (9.1 ton capacity)  
 Portable iron oven pusher  
 225-foot chimney

Coke Handling Area

Coke quenching station  
 Water reservoir  
 Calcium chloride treating tank  
 Screening coke crusher

Generating Plant

Boiler house (2 turbines,  
 2 boilers inside)  
 Concrete chimney  
 Truck scale

Miscellaneous Structures

Truck scales  
 Machine shop  
 Office building  
 Laboratory  
 Service building  
 Meter house

Former Wood Treatment Plant  
Facilities

4 steel creosote storage tanks  
 Planing mill  
 Tie treating building  
 Creosote weighing vanes  
 Overhead metal conveyor  
 Storage building  
 Sheds

<sup>a</sup>Wood Treating Facility - Sanborn Fire Insurance Map, 1917

<sup>b</sup>Manufactured Gas Plant - OMC, 1990; and North Shore Gas Company, 1990

TABLE 4.1-1  
POTENTIAL CHEMICALS OF CONCERN  
MANUFACTURED GAS PLANT SITES

Purification Process	Coal Ash	Coal Tar		
INORGANICS	METALS	VOLATILE AROMATICS	PHENOLICS	POLYNUCLEAR AROMATIC HYDROCARBONS
Ammonia	Aluminum	Benzene	Phenol	Acenaphthene
Cyanide	Antimony	Ethyl Benzene	2-Methylphenol	Acenaphthylene
Nitrate	Arsenic	Toluene	4-Methylphenol	Anthracene
Sulfate	Barium	Total Xylene	2,4-Dimethylphenol	Benzo(a)anthracene
Sulfide	Cadmium			Benzo(a)pyrene
Thiocyanates	Chromium			Benzo(b)fluoranthene
	Copper			Benzo(g, h, i)perylene
	Iron			Benzo(k)fluoranthene
	Lead			Chrysene
	Manganese			Dibenzo(a, h)anthracene
	Mercury			Dibenzofuran
	Nickel			Fluoranthene
	Selenium			Fluorene
	Silver			Naphthalene
	Vanadium			Phenanthrene
	Zinc			Pyrene
				2-Methylnaphthalene

Source: GRI, 1987. "Management of Manufactured Gas Plant Sites, Volume I"

TABLE 4.4-1  
MAJOR CONSTITUENTS OF COAL TAR, PER FISHER (1938)<sup>(a, b)</sup>  
(PERCENTAGES BASED ON THE ORIGINAL TAR)

	Major Fraction	Fraction	Subfraction
Coal Tar			
Light oil, up to 200°C	5.0	--	--
Benzene	--	0.1	--
Toluene	--	0.2	--
Xylene	--	1.0	--
Heavy solvent naphtha	--	1.5	--
Middle oil, 200-250°C	17.0	--	--
Tar acids	--	2.5	--
Phenol	--	--	0.7
Cresols	--	--	1.1
Xylenols	--	--	0.2
Higher tar acids	--	--	0.5
Tar Bases	--	2.0	--
Pyridine	--	--	0.1
Heavy bases	--	--	1.9
Naphthalene	--	10.9	--
Unidentified	--	1.7	--
Heavy oil 250-300°C	7.0	--	--
Methylnaphthalenes	--	2.5	--
Dimethylnaphthalenes	--	3.4	--
Acenaphthene	--	1.4	--
Unidentified	--	1.0	--
Anthracene oil, 300-350°C	9.0	--	--
Fluorene	--	1.6	--
Phenanthrene	--	4.0	--
Anthracene	--	1.1	--
Carbazole	--	1.1	--
Unidentified	--	1.2	--
Pitch	62.0	--	--
Gas	--	2.0	--
Heavy oil	--	21.8	--
Red wax	--	7.0	--
Carbon	--	32.0	--

Source: Utility Solid Waste Activities Group, 1984

- (a) Reproduced from Wilson & Wells (1950, p. 374) and referenced from Shreve, 1945 (p. 91).
- (b) Also reported in Gas Engineers Handbook (1966, p. 3/17) and referenced as being obtained from Fisher, 1938.

TABLE 4.4-2  
COMPARISON OF THE PHYSICAL PROPERTIES OF  
COAL TAR AND CREOSOTE

	Creosote <sup>a</sup>	Creosote <sup>b</sup>	Coke Oven <sup>c</sup> Coal Tar
Benzene insoluble, % wt.		0.99	4.6
Distillation, % wt.			
up to 210°C	2	1.87	1.8
235°C	12	6.89	7.1
270°C	20-40	19.39	18.2
315°C	45-65	49.8	28.3
355°C	65-82	72.58	41.9
Residue above 355°C		26.67	57.6
Specific Gravity		1.10	1.18

<sup>a</sup> American Wood-Preservers' Association Standards (Pl-65) for land and freshwater use.

<sup>b</sup> Lorenz and Sjovik, 1972.

<sup>c</sup> Martin, 1949

TABLE 4.4-3

## PHYSICAL AND CHEMICAL PROPERTIES OF PAH AND VOLATILE ORGANIC COMPOUNDS

Compound	Molecular Weight	Water Solubility @ 25° C (mg/L)	PARTITION COEFFICIENTS			VOLATILIZATION CONSTANTS		
			K <sub>ow</sub> Octanol/Water (Unitless)	K <sub>oc</sub> Organic Carbon/Water (ml/g)	K <sub>b</sub> Microorganism/Water (μg/g) (mg/L) <sup>-1</sup>	Vapor Pressure 25° C (Torr)	Henry's Law Constant atm m <sup>3</sup> mol <sup>-1</sup>	Diffusion Coefficients @ 20° C (cm <sup>2</sup> /sec)
PAH								
Acenaphthene	154.21	3.42	9.6 E+3	4.6 E+3	1.8 E+3	1.55 E-3	9.10 E-5	0.205964
Acenaphthylene	152.20	3.93	5.3 E+3	2.5 E+3	1.0 E+3	2.90 E-2	1.45 E-3	0.06600
Anthracene	178.23	0.045	2.8 E+4	1.4 E+4	4.7 E+3	1.70 E-5	8.60 E-5	0.05547
Benzo(a)anthracene	228.29	0.0057	4.1 E+5	2.00 E+5	5.3 E+4	2.20 E-8	1.16 E-6	0.05002
Benzo(a)pyrene	252.30	0.0038	1.15 E+6	5.50 E+5	1.40 E+5	5.60 E-9	4.90 E-7	0.04550
Benzo(b)fluoranthene	252.32	0.014	1.15 E+6	5.50 E+5	1.40 E+5	5.00 E-7	1.19 E-5	0.04550
Benzo(g, h, i)perylene	276.00	0.00026	3.20 E+6	1.60 E+6	3.50 E+5	1.03 E-10	1.44 E-7	0.04305
Benzo(k)fluoranthene	252.00	0.0043	1.15 E+6	5.5 E+5	1.40 E+5	5.10 E-7	3.87 E-5	0.04550
Chrysene	228.30	0.0018	4.10 E+5	2.0 E+5	5.30 E+4	6.30 E-9	1.05 E-6	0.05002
Dibenzo(a, h)anthracene	278.35	0.0005	6.9 E+6	3.3 E+6	6.9 E+5	1.00 E-10	7.33 E-8	0.04332
Fluoranthene	202.00	0.265	7.9 E+4	3.8 E+4	1.2 E+4	5.00 E-6	6.46 E-6	0.05314
Fluorene	166.00	1.69	1.5 E+4	7.3 E+3	3.8 E+3	7.10 E-4	6.42 E-5	0.05862
Indeno(1, 2, 3-cd)pyrene	276.34	0.00053	3.2 E+6	1.6 E+6	3.5 E+5	1.00 E-10	6.86 E-8	0.04305
Phenanthrene	178.22	1.00	2.8 E+4	1.4 E+4	4.7 E+3	6.80 E-4	1.59 E-4	0.05547
Pyrene	202.26	0.13	8.0 E+4	3.8 E+4	1.2 E+4	2.50 E-6	5.04 E-6	0.05314
NAPHTHALENES								
Naphthalene	128.2	31.7	1.95 E+3	9.4 E+2	4.2 E+2	8.70 E-2	4.6 E-4	
VOLATILE ORGANICS								
Benzene	78.11	1,780	1.35 E+2	6.5 E+1	3.7 E+1	9.5 E+1	5.5 E-3	
Toluene	92.13	534.8	6.20 E+2	3.0 E+2	1.48 E+2	2.87 E+1	6.66 E-3	
Ethylbenzene	106.16	152	2.2 E+3	1.1 E+3	4.7 E+2	7.0 E-0	6.6 E-3	
Xylenes	106.16	175	1.58 E+3	2.4 E+2	---	6.0 E-0	5.1 E-3	

Note: Scientific notation presented as 9.6 E+3 which represents  $9.6 \times 10^3$ .

TABLE 4.5-1  
POTENTIAL EXPOSURE PATHWAYS

Release Mechanism	Exposure Pathway	Exposure Point	Potential Receptors	Exposure Route	Exposure Potential
<b>Current Site Conditions:</b>					
Release of MGP byproducts to shallow groundwater	Water supply use of shallow groundwater	Onsite	Groundwater users	Ingestion Inhalation Dermal absorption	None. No water supply wells are present
Discharge of contaminated groundwater to surface water	Direct contact with surface water	Waukegan Harbor/Marina	Recreational users/boaters	Ingestion Dermal absorption	Limited. Boaters could have contact with surface water. Groundwater will be diluted in surface water
Discharge of contaminated groundwater to surface water	Direct contact with surface water	Waukegan Harbor	Aquatic organisms	Bioconcentration, Ingestion Bioaccumulation	Limited. Depends on dilution with surface water. Chemical specific and species specific. Some chemicals lost because of volatilization; and degradation
Discharge of contaminated groundwater to surface water	Uptake of contaminants by aquatic organisms. Organisms caught by people fishing	Waukegan Harbor	People who consume fish	Ingestion	Limited. People may fish in the harbor. Consumption may be limited because of fish advisories. Concentration present in fish affected by bioconcentration potential and concentrations present in surface water.
Discharge of contaminated groundwater to surface water	Water supply use of Lake Michigan water	Residences	People consuming municipal water supply	Ingestion Dermal absorption Inhalation	Very limited. Water intake is over 1 mile from site. Extreme dilution of contaminants likely. Chemicals may be lost because of volatilization, sorption, and degradation.
Contaminated surface soil	Direct contact	Onsite	Site visitors, Terrestrial organisms	Ingestion Dermal absorption	Unknown. Surface contamination not defined although believed to be limited.
Volatilization and diffusion of volatile constituents of MGP residue	Release to the ambient air	Onsite	Site visitors	Inhalation	Limited. Extent of subsurface contamination unknown. Volatile compounds released will be diluted with ambient air.

TABLE 4.5-1 (continued)

Release Mechanism	Exposure Pathway	Exposure Point	Potential Receptors	Exposure Route	Exposure Potential
<b>Future Site Conditions:</b>					
Release of MGP by products to shallow groundwater	Water supply use of shallow groundwater	Onsite	Future groundwater users	Ingestion Inhalation Dermal absorption	None. Installation of water supply wells unlikely. Water supply available from city.
Exposure of soil containing MGP residuals as a result of site development	Direct contact with soils	Areas around proposed boat slip/marina	Marina visitors/boat yard workers	Ingestion Dermal absorption	Limited. Depends on materials excavated and their placement.
Exposure of soil containing MGP residuals as a result of utility line installation or repairs	Direct contact with soil - inhalation within trenches	Onsite	Utility worker	Ingestion Dermal absorption Inhalation	Limited. Depends on location of utility lines and work practices of construction workers.
Exposure of soil containing MGP residuals as a result of utility line installation or repairs	Direct contact with residuals left exposed after development	Onsite	Future occupants	Ingestion Dermal absorption	Limited. Depends on location of development, placement of residuals and type of site use.

TABLE 6.3-1  
PHASE I RI SAMPLING SUMMARY

Sampling Activity	Objective	Estimated No. of Samples	Analytical Parameters	Rationale for Sample Selection
Preliminary Source Area Characterization	Qualitatively identify PAH-contaminated soil for selection of sample locations and Phase II boring locations	140	Field soil classification, visual examination, field oil sheen test, odor observations, field headspace organic vapor screening	One sample to characterize each different-appearing soil encountered; periodic sampling for assessing continuity of similar-appearing soils.
	Characterize nature of key chemical constituents in identified source area wastes/soils	12 of 25	PAHs, VOCs	One sample to characterize each distinct type of visual contamination; assess different levels of visual contamination.
	As above, plus assess levels of phenols and possible correlation with PAHs	5 of 25	PAHs, VOCs, Phenols	Approximately 20% of samples analyzed for PAHs; assess different levels of visual contamination.
	Characterize nature of key chemical constituents associated with thionizer process	3 of 25	PAHs, VOCs, Arsenic, Cyanide	From trenches near Thionizer Building.
	Assess full-range of chemical constituents in identified source area waste/soil	4 of 25	Full-Scan <sup>(1)</sup>	One from apparent coal-tar waste; one from apparent contamination in new slip area; one from each shallow boring in former pond areas.
	Assess full-range of chemical constituents and leaching characteristics of compacted coal fines layer	1 of 25	Full-Scan <sup>(1)</sup> , TCLP	From compacted coal fines layer in slip area.
Background Soil Sampling	Assess off-site concentrations of full-range of chemical constituents in soils at surrounding industrial and non-industrial locations	8	Full-Scan <sup>(1)</sup>	Pre-Determined Locations
Surficial Soil Sampling	Assess nature of on-site soils relative to full-range of chemical constituents	17	Full-Scan <sup>(1)</sup>	Pre-Determined Locations
Groundwater Sampling	Characterize groundwater quality	10	Full-Scan <sup>(1)</sup>	New and Pre-Existing Monitoring Wells

<sup>(1)</sup>Semivolatiles, VOCs, Metals, PCBs, Pesticides

TABLE 6.3-2  
PHASE II RI SAMPLING SUMMARY

Sampling Activity	Objective	Estimated No. of Samples	Analytical Parameters	Rationale for Sample Selection
Soils Investigation	Stratigraphic characterization and qualitative identification of PAH-contaminated soil for selection of samples for analyses	480	Field soil classification, visual examination, field oil sheen test, odor observations, field headspace organic vapor screening, field pH	Split-barrel samples collected from borings at 2½-foot intervals
	Assess vertical and horizontal extent of key chemical constituents	102	PAHs, BETX	One near-surface sample from each boring; one sample from sand/till contact at each boring; additional samples based on visual contamination, stratigraphy
	As above, plus assess levels of phenols and possible correlation with PAHs	28	PAHs, BETX, Phenols	Approximately 20% of samples analyzed for PAHs; assess different levels of visual contamination
	Assess vertical and horizontal extent of key chemical constituents and characteristics associated with thionizer process	10	PAHs, BETX, Arsenic, Cyanide, Corrosivity, Reactivity	From borings near Thionizer Building/Sulfur Pile
	Determine basic soil characteristic data	6	Grain size distribution, porosity	3 samples from till, 3 from sand to provide areally representative samples
	Determine basic soil characteristic data	3	Atterberg Limits	1 sample of till from each of 3 borings to provide areally representative samples
	Assess adsorptive nature of sand and till units	6	Total organic carbon	3 samples from till, 3 from sand to provide areally representative samples
	Assess vertical permeability of till	3	Vertical permeability	1 sample from each of 3 borings to provide areally representative samples
	Assess potential treatability alternatives	3	TCLP, gross heating value, flashpoint	3 samples from different areas of soils identified as containing coal tar

TABLE 6.3-2 (continued)

Sampling Activity	Objective	Estimated No. of Samples	Analytical Parameters	Rationale for Sample Selection
Groundwater Sampling	Refine groundwater quality characterization	22	PAHs, BETX, Phenols	1st Round from Phase II monitoring wells; 2nd Round from all monitoring wells; selected samples for low-level PAH analysis based on Phase I results.
	Assess potential treatability alternatives	6	BOD/COD, oil & grease, total suspended solids	1 sample from each well showing relatively high chemical constituent concentrations.

TABLE 6.12-1  
ESTIMATED DURATION OF PROJECT TASKS

ACTIVITY	START	TASKS	TASK DURATION (WEEKS)	CUMULATIVE DURATION <sup>(1)</sup> (WEEKS)
Phase I Field Investigation	Work Plan Approved	Investigation Support	7	7
		Test Trenching	4	9
		Surficial Soil/Background Sampling	4	9
		Monitoring Wells/Soil Borings	4	13
		Groundwater Sampling/Slug Tests	2	15
		Ecological Survey	2	19
		Sample Analysis/Validation	11	19
		Data Evaluation/Modeling	13	21
		Phase I Tech Memo	9	26
		Revised ARARs/PRG Tech Memo	5	27
		EPA Review	4	30
Phase II Field Investigation	Phase I Tech Memo Approved	Investigation Support	9	39
		Soil Borings	5	39
		Monitoring Wells	4	43
		Pumping Test	1	43
		Groundwater Sampling (1)	1	43
		Sample Analysis/Validation (1)	11	50
		Groundwater Sampling (2)	1	50
		Sample Analysis/Validation (2)	4	54
		Data Evaluation	22	60
		Preliminary Characterization Summary	5	60
		EPA Review	2	62

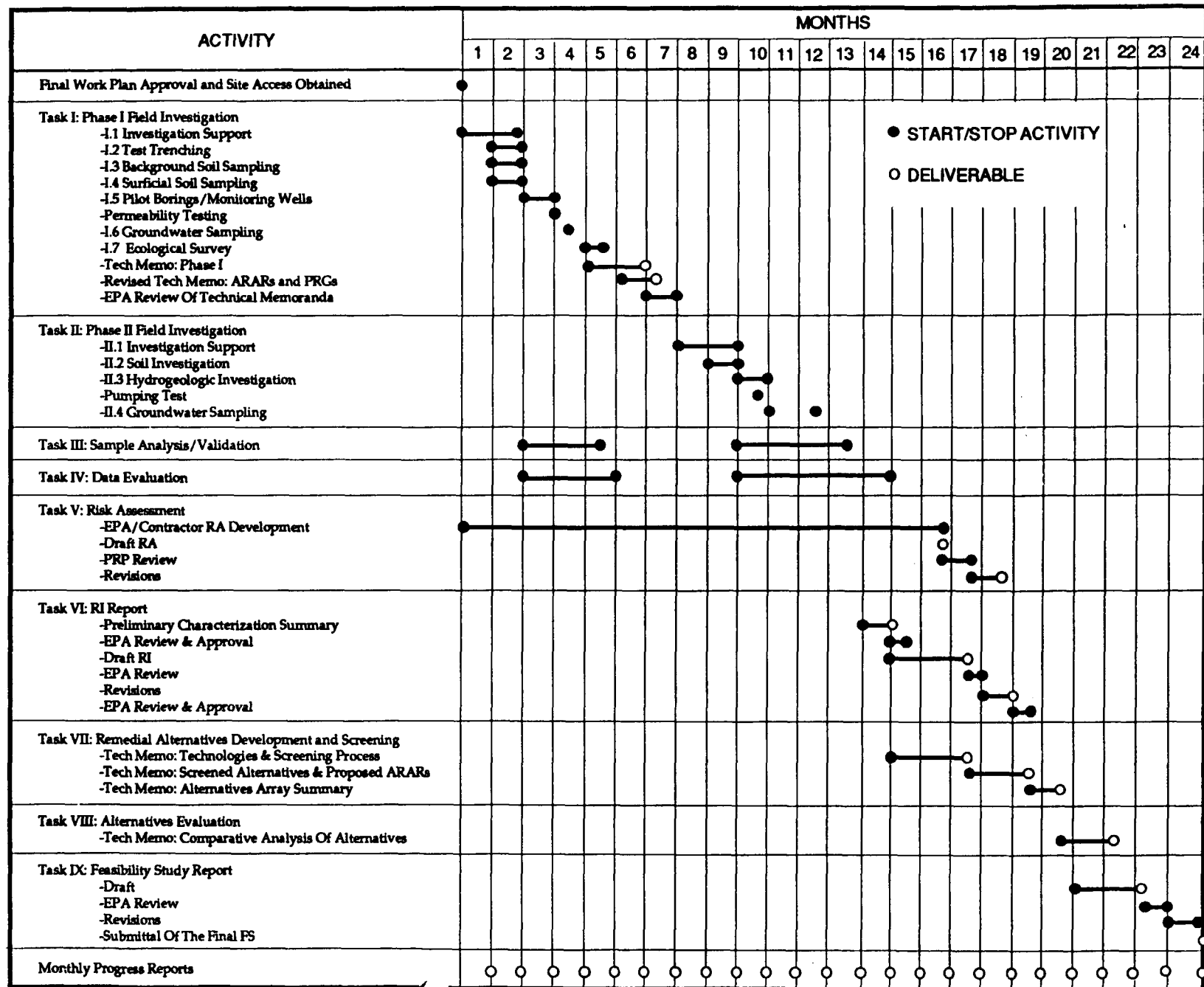
<sup>(1)</sup>Accounts for concurrent tasks.

TABLE 6.12-1 (continued)  
ESTIMATED DURATION OF PROJECT TASKS

ACTIVITY	START	TASKS	TASK DURATION (WEEKS)	CUMULATIVE DURATION <sup>(1)</sup> (WEEKS)
RI Report/RA Development and Screening	Preliminary Characterization Summary Approved	Prepare Draft RI Report	12	71
		Prepare Tech Memo on Technologies and Screening Process	12	71
		EPA Review	2	73
		Revisions to Draft RI	4	77
		Prepare Screened Alternatives and Proposed ARARS Tech Memo	9	79
		EPA Approval; Risk Assessment	2;68	79
Alternatives Summary and Evaluation/FS Report	EPA Risk Assessment Completed	PRP Review of Risk Assessment	4	79
		EPA Response	4	79
		Prepare Tech Memo on Alternatives Array Summary	5	84
		Prepare Tech Memo on Comparative Analysis of Alternatives	8	92
		Prepare Draft FS Report	10	97
		EPA Review	2	99
		Revisions to Draft FS/ Submittal of Final FS	5	104
PROJECT TOTAL:				104 weeks (24 months)

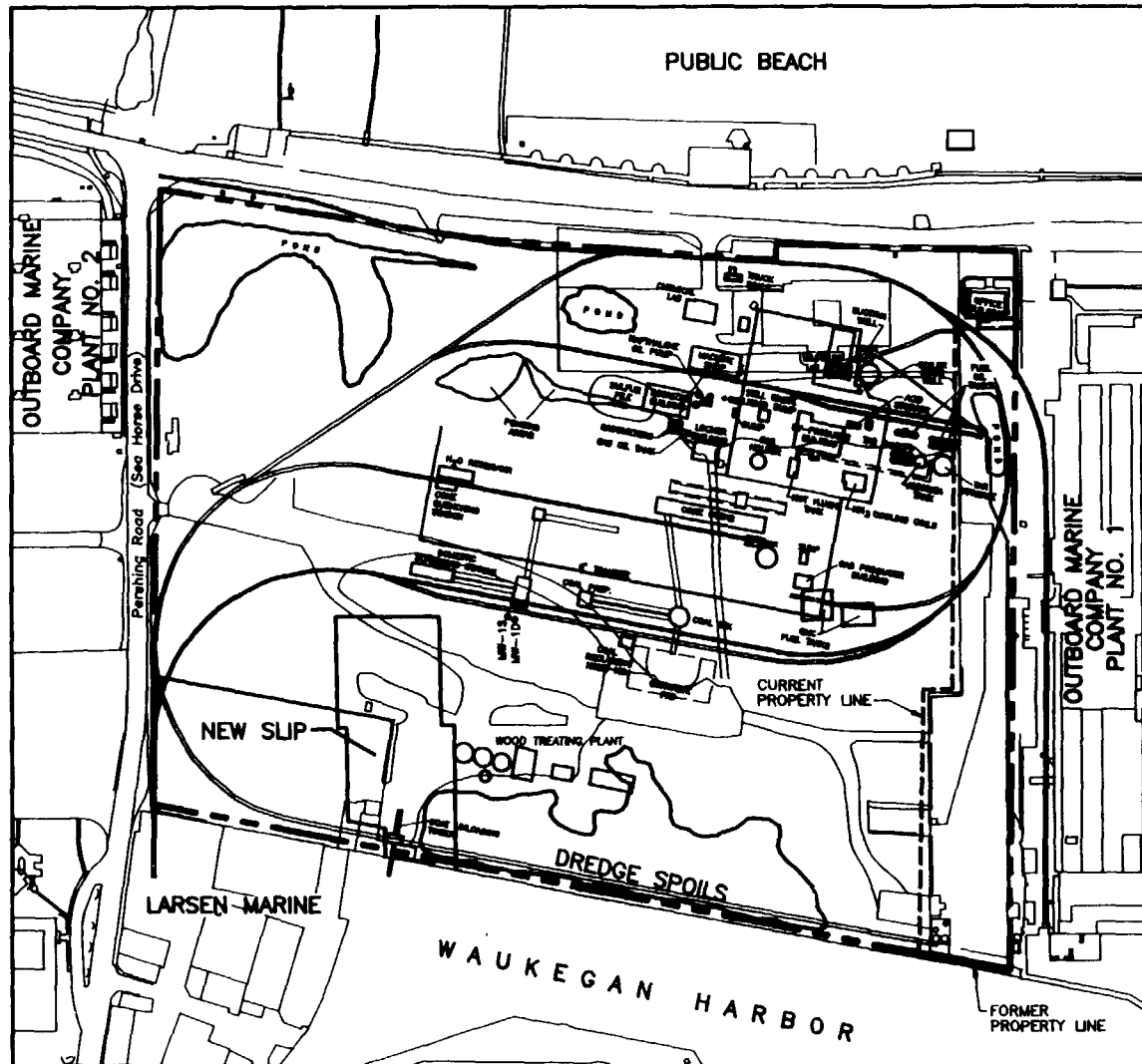
<sup>(1)</sup>Accounts for concurrent tasks.

**TABLE 6.12-2  
ESTIMATED PROJECT SCHEDULE**



## *Figures*





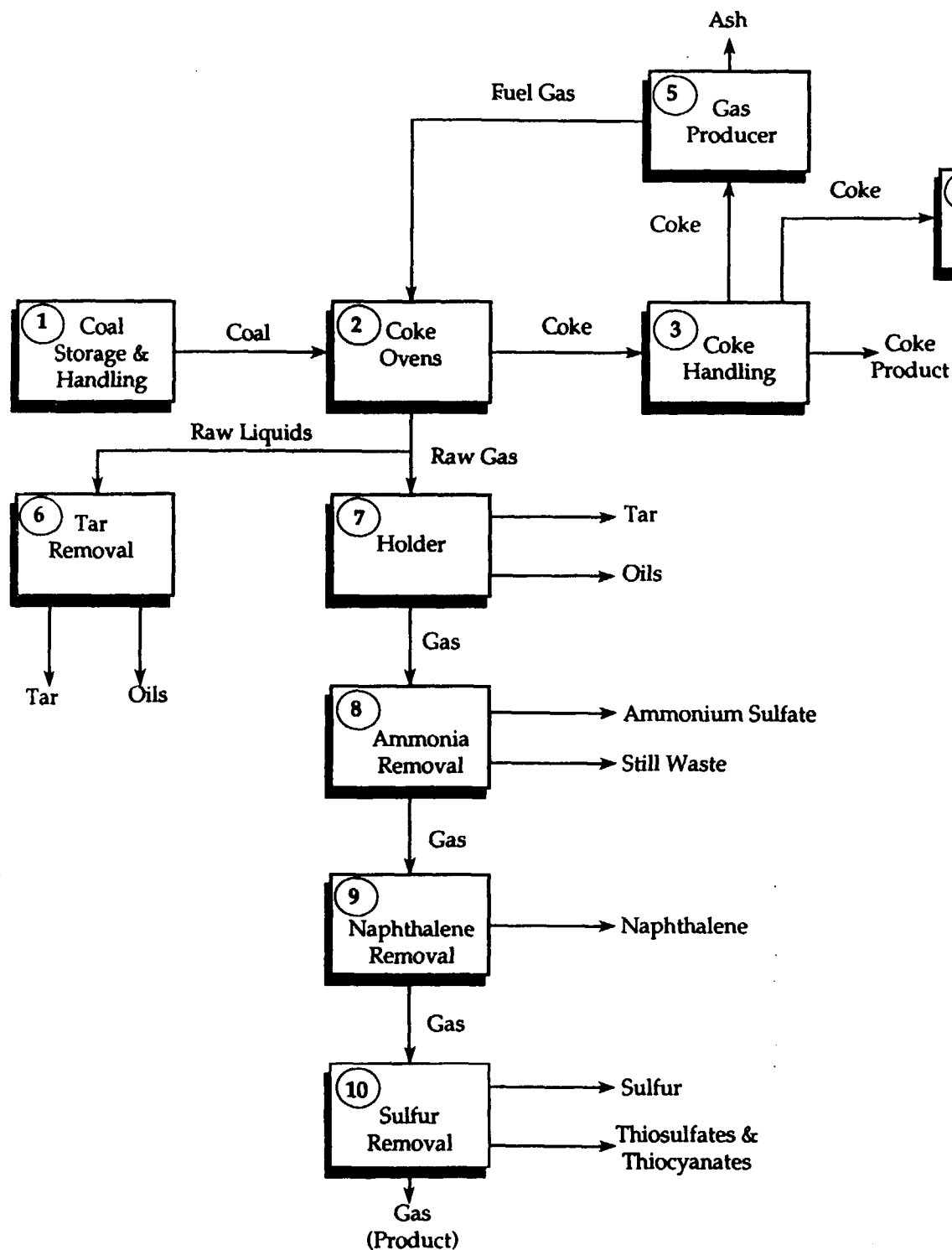
0 200 400  
SCALE IN FEET

Base Map and locations of existing facilities provided by OMC.

Approximate location of Wood Treating Plant determined from USACE Map, 1908, and Sanborn Fire Insurance Map, 1917.

Locations of Coke Plant Facilities from aerial photographs and Sanborn Fire Insurance Maps.

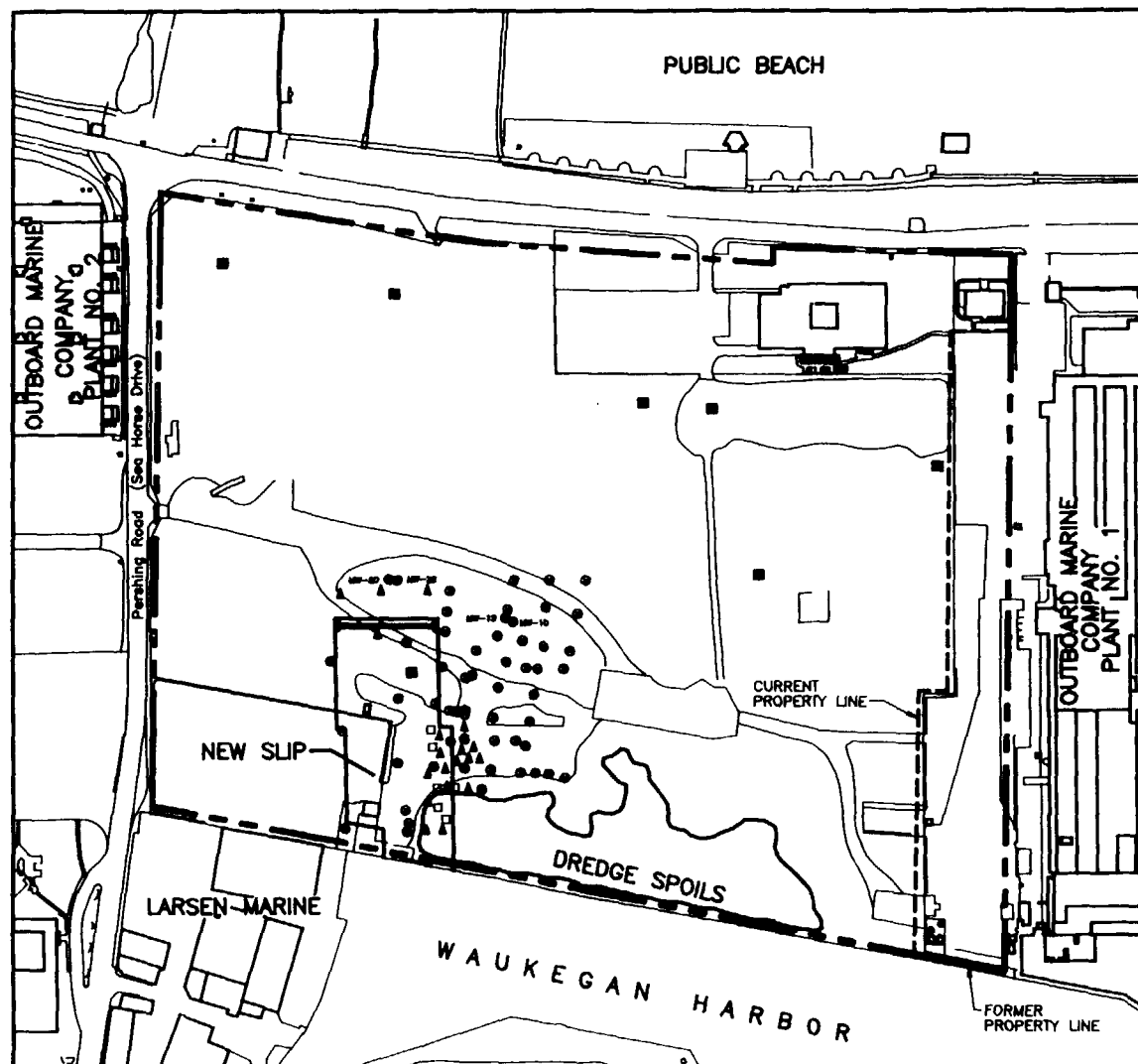
Figure 2.3-1  
WAUKEGAN MANUFACTURED GAS AND COKE PLANT SITE



- FACILITIES ASSOCIATED WITH PROCESS STEPS (FIGURE 2.3-1)**
- ① Boat Unloading Tower; Concrete Pad; Coal Reclaiming Hoist House; Coal Mix; Coal Preparation.
  - ② Coke Ovens.
  - ③ H<sub>2</sub>O Reservoir; Coke Quenching Station; Domestic Screening Station.
  - ④ Suction Well; Boiler House; Boiler Room Well.
  - ⑤ Gas Producer Building; Sump.
  - ⑥ Hot Flush Tank; NH<sub>3</sub> Cooling Coils; Tar Tanks; Tar Storage; Fuel Oil.
  - ⑦ Gas Holder
  - ⑧ By-Products Building; Acid Storage; Still Waste Liquid Sump.
  - ⑨ Naphthalene Oil Pump; Gas Oil Tank; Sump.
  - ⑩ Thionizer Building; Sulfur Pile

**Figure 2.3-2**

**FLOW CHART  
MANUFACTURED GAS/COKE  
PROCESSES**



- - IEPA Soil Boring<sup>(1)</sup>
  - - New Slip Soil Investigation Boring<sup>(2)</sup>
  - MW-1S - Monitoring Well<sup>(2)</sup>  
(MW-2S, MW-2D Abandoned)
  - ▲ - New Slip Supplemental Investigation Boring<sup>(3)</sup>
  - - Test Trench Location<sup>(3)</sup>
  - - Surficial Soil Samples<sup>(3)</sup>
- (1) - IEPA, 1989  
 (2) - Canole Enviromental Inc., 1990  
 (3) - Canole Enviromental Inc., 1991a

Figure 2.4-1  
 PREVIOUS INVESTIGATIONS  
 SOIL BORING AND MONITORING WELL  
 LOCATIONS

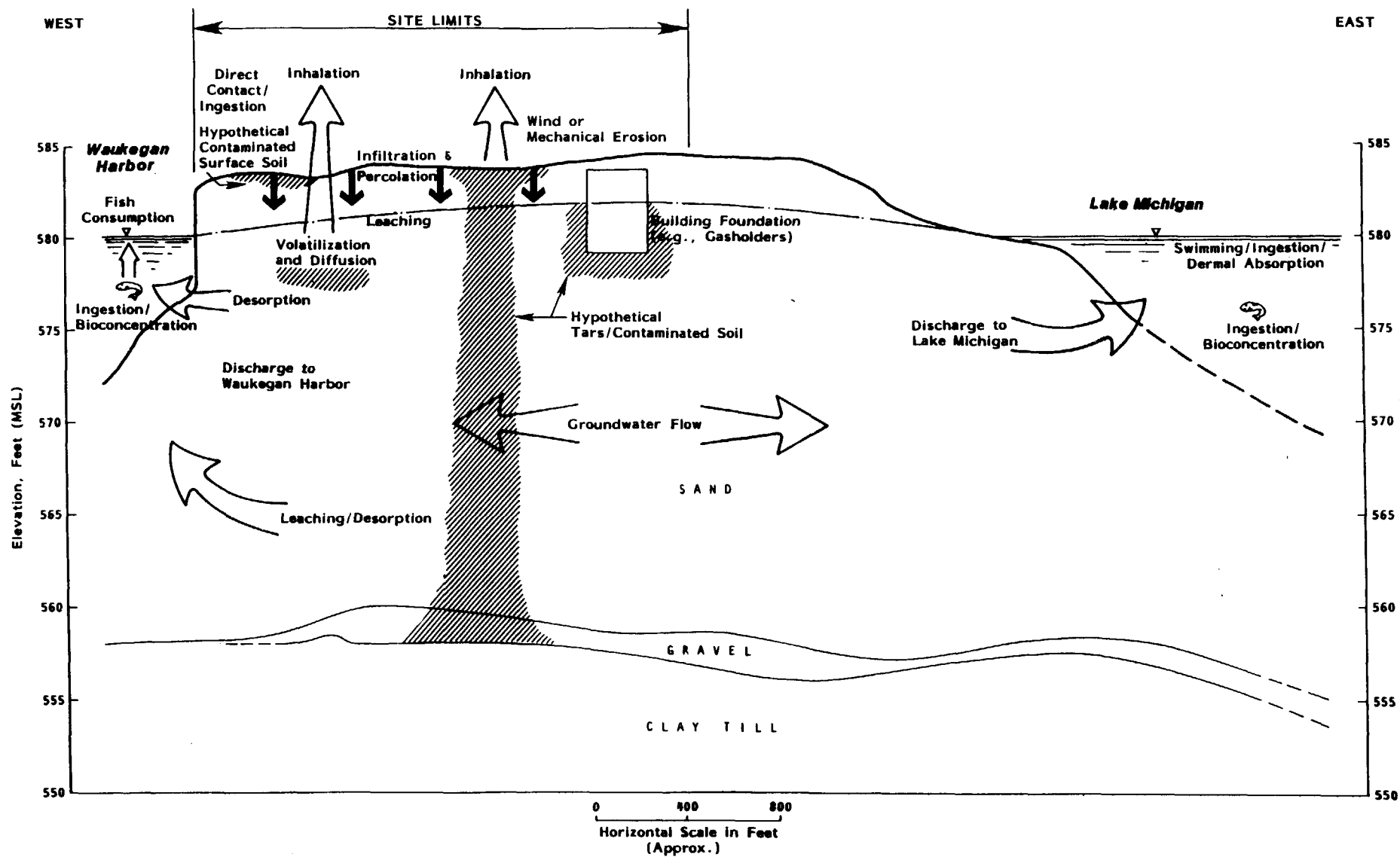


Figure 4.5-1  
CONCEPTUAL SITE MODEL  
Potential Contaminant Release and Migration

GENERAL RESPONSE	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
No Action	None			
In Situ Treatment	Biological Treatment	Anaerobic	System of seeding micro-organisms that degrade organics in an oxygen free environment.	Potentially viable.
		Aerobic	System of injection wells to add oxygen, nutrients and bacteria to the medium.	Potentially viable.
	Physical-Chemical Treatment	Chemical Fixation	Injection of chemicals in wells to precipitate/dissolve contaminants. Experimental.	Not appropriate. Applicable to metals and inorganics.
		Soil Flushing	Injection of water with detergents, then capture and treatment of effluent.	Potentially viable.
		Soil Stabilization	Process of mixing cementing material such as lime, flyash or portland cement to bind/stabilize.	Potentially viable.
		Vapor Extraction	Series of wells and vacuum pumps to remove volatile compounds.	Potentially viable.
Removal	Excavation			Potentially viable.
Leachate Collection	Wells	Extraction Wells	Series of wells to remove leachate.	Potentially viable.
		Injection Wells	Controls direction of groundwater flow.	Potentially viable.
	Drains	Subsurface Drains	Perforated pipe laid in trenches to intercept horizontal flow over an aquitard.	Potentially viable.
Containment	Vertical Barrier	Bent-Soil Slurry Wall	Trench is backfilled with soil-bentonite slurry as excavation proceeds. Has little structural strength.	Potentially viable.
		Bent-Cement Slurry Wall	Trench is backfilled with bentonite-portland cement mix. May be used where some strength is needed.	Potentially viable.
		Grout Curtain	Pressure injection of grout in holes drilled in line.	Potentially viable.
		Sheet Piles	Steel sheet piles are driven around perimeter.	Potentially viable.
	Cap	Soil Cover	Regrade and fill as needed to maximize runoff and minimize erosion of contaminants.	Potentially viable.
		Clay Cap	Cover area with layer of compacted clay and slope to drain and seep.	Potentially viable.
		Flexible Membrane Cap	Cover area with impermeable, flexible membrane. Membrane is protected with soil cover.	Potentially viable.
		RCRA Type Cap	Multi-layer cap conforming to RCRA.	Potentially viable.
Treatment	Biological Treatment	Land Spreading	Thin spreading of contaminated soil over land. Bacteria in soil plus sun degrade organics.	Potentially viable.
		Composting	Bacterial destruction of contaminants in soil in an aerobic environment.	Potentially viable.
		Liquids/Solids	Process to extract organics from soils in an aqueous phase.	Potentially viable.
		Soil Washing	Removal of organic contaminants using a wash of detergents or solvents.	Potentially viable.
	Physical/Chemical Treatment	Stabilization	Mixing of media with cementing material such as asphalt, lime, flyash or portland cement.	Potentially viable.
		Incineration	Destruction by burning at very high temperatures.	Potentially viable.
		Thermal Desorption	Volatilization of organics at high temperature.	Potentially viable.
		Vitrification	Conversion of soil to glass at very high temperature.	Potentially viable.
		On Site Disposal	Backfill excavation on site with treated soil or vault.	Potentially viable.
		Sanitary Landfill		Potentially viable.
Disposal		RCRA Vault	At a commercial facility in Illinois.	Potentially viable.
Monitoring			Long-term monitoring of site conditions and contaminant levels.	Potentially viable.
Access/Use Restriction			Restrict use of site.	Potentially viable.

Figure 5.5-1  
IDENTIFICATION OF POTENTIALLY  
VIALE REMEDIAL TECHNOLOGIES AND  
PROCESS OPTIONS FOR SOILS

GENERAL RESPONSE	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
No Action	None			
In Situ Treatment	Biological Treatment	Microencapsules-Injectable	Experimental	Not appropriate due to experimental nature.
		Microencapsules-Injectable	System of injection wells to add oxygen/nutrients and bacteria to medium.	Potentially viable.
	Physical/Chemical Treatment	Stripping	System of injection wells used to inject air or steam into groundwater where volatiles are removed by air stripping.	Potentially viable.
		Chemical Precipitation	Chemical complexation and precipitation of metals and inorganics.	Not appropriate. Applicable to metals and inorganics.
Assess/Use Restrictions		Chemical Reaction	System of wells to inject oxidizer such as ozone or hydrogen peroxide.	Potentially viable.
			Restrict use of site. Restrict use of groundwater in surrounding area. Legally difficult.	Not appropriate.
Collection	Wells	Extraction Wells	Series of wells to pump out contaminated groundwater.	Potentially viable.
		Injection Wells	Wells used to inject clean water to increase flow of contaminants to extraction wells.	Potentially viable.
	Drains	Subsurface Drains	Perforated pipe laid in trenches to intercept horizontal flow, over an aquiclude.	Potentially viable.
		Sheet-Pile Drains	Trench is backfilled with sand-bentonite slurry as excavation proceeds. Effectiveness limited to depths of 100' ±.	Potentially viable.
Containment	Vertical Barrier	Sheet-Cement Slurry Wall	Trench is backfilled with bentonite-cement mix. May be used where strength is needed such as under roads.	Potentially viable.
		Grout Curtain	Pressured injection of grout in holes drilled in line.	Potentially viable.
	Cap	Sheet Piles	Steel sheet piling driven around perimeter.	Potentially viable.
Treatment	Biological Treatment	Soil Cover	Regrade and fill as needed to maximize runoff and minimize erosion of contaminants.	Not appropriate. Phase of contaminated water already in capillary.
		Clay Cap	Cover area with layer of compacted clay and slope to drain.	Not appropriate. Phase of contaminated water already in capillary.
		Flexible Membrane Cap	Cover area with impermeable flexible membrane. Cover membrane with soil and seed.	Not appropriate. Phase of contaminated water already in capillary.
		Aerobic	Use micro-organisms in a oxygen rich environment to degrade organics.	Potentially viable.
	Physical/Chemical Treatment	Anaerobic	Use micro-organisms in an oxygen starved environment to degrade organics.	Potentially viable.
		Coagulation/Filtration	Variable level of treatment that may include sedimentation, flocculation, filtering, phase separation.	Not appropriate for low-level volatile organic contaminants.
		Precipitation	Alteration of chemical equilibria to reduce solubility.	Not appropriate. Ineffective with organics.
		Air Stripping	Mixing large volumes of air with water in a packed column to promote evaporation of contaminants.	Potentially viable.
		Steam Stripping	Like air stripping but uses steam.	Potentially viable.
		Carbon Adsorption	Passage of water over activated carbon where contaminants adhere to carbon surface.	Potentially viable.
		Photolysis	Oxidation of organics using ozone or peroxide/UV.	Potentially viable.
		Reverse Osmosis	Use of high pressure to force water through a filtering membrane.	Not appropriate. Ineffective with many light organics.
		Chemical Oxidation	Tank mixing with oxidizers such as hydrogen peroxide.	Potentially viable.
		Spray Evaporation	Removal of volatile constituents by boiling. May require pretreatment for light volatiles.	Not appropriate. Redundant to pretreatment.
		Hot Air Oxidation	Oxidation of organics in aerator under high temperature and pressure.	Not appropriate for destruction of low-level organic contaminants in water.
		Sonic Treatment	Experimental method to separate organics from water.	Not appropriate.
		Ion Exchange	Chemical reaction with resins to remove metals/cyanide.	Not appropriate. Ineffective with organic compounds.
		Adsorption/Flotation	Adsorption removal process.	Potentially viable.
Off-Site Treatment	Thermal Destruction			Not appropriate for destruction of low-level organic contaminants in water.
				Potentially viable.
	POTW	Public Wastewater Treatment Plant	Activated sludge treatment.	Potentially viable.
Treatment of Water Body	Private Treatment	RCRA Facility	Ship to RCRA licensed facility for treatment and disposal.	Potentially viable.
		Industrial Facility	Ship to oil refinery or chemical plant with water treatment facility.	Potentially viable.
Direct Discharge	Lake Michigan	Carbon Adsorption	Passage of water through activated carbon where contaminants are adsorbed to carbon surface.	Potentially viable.
Monitoring	Waukegan Harbor		Discharge contaminated groundwater to Lake Michigan	Potentially viable.
			Discharge contaminated groundwater to Waukegan Harbor	Potentially viable.
			Long-term monitoring of site conditions and contaminant levels.	Potentially viable.

Figure 5.5-2  
IDENTIFICATION OF POTENTIALLY  
VIABLE REMEDIAL TECHNOLOGIES AND  
PROCESS OPTIONS FOR GROUNDWATER

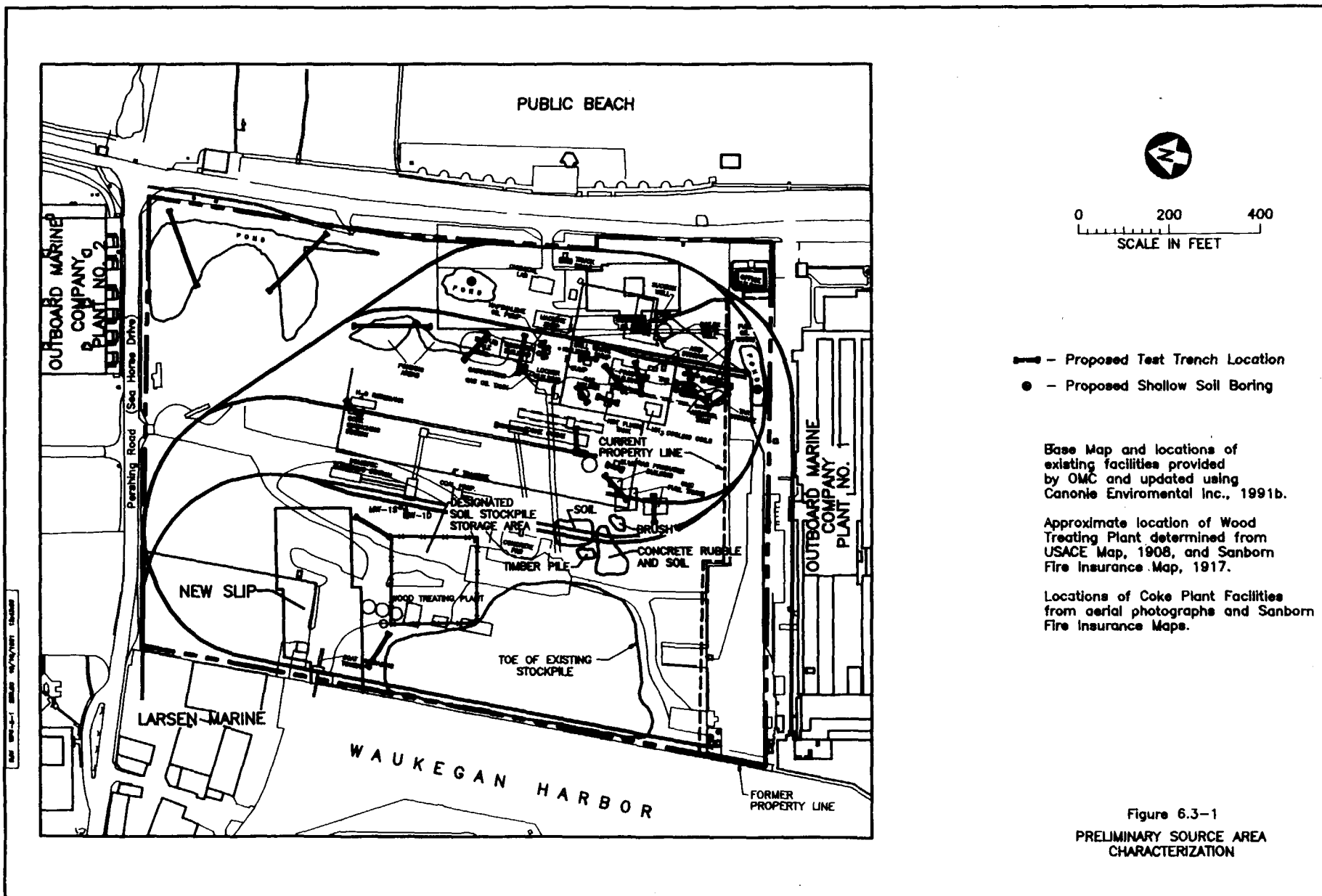
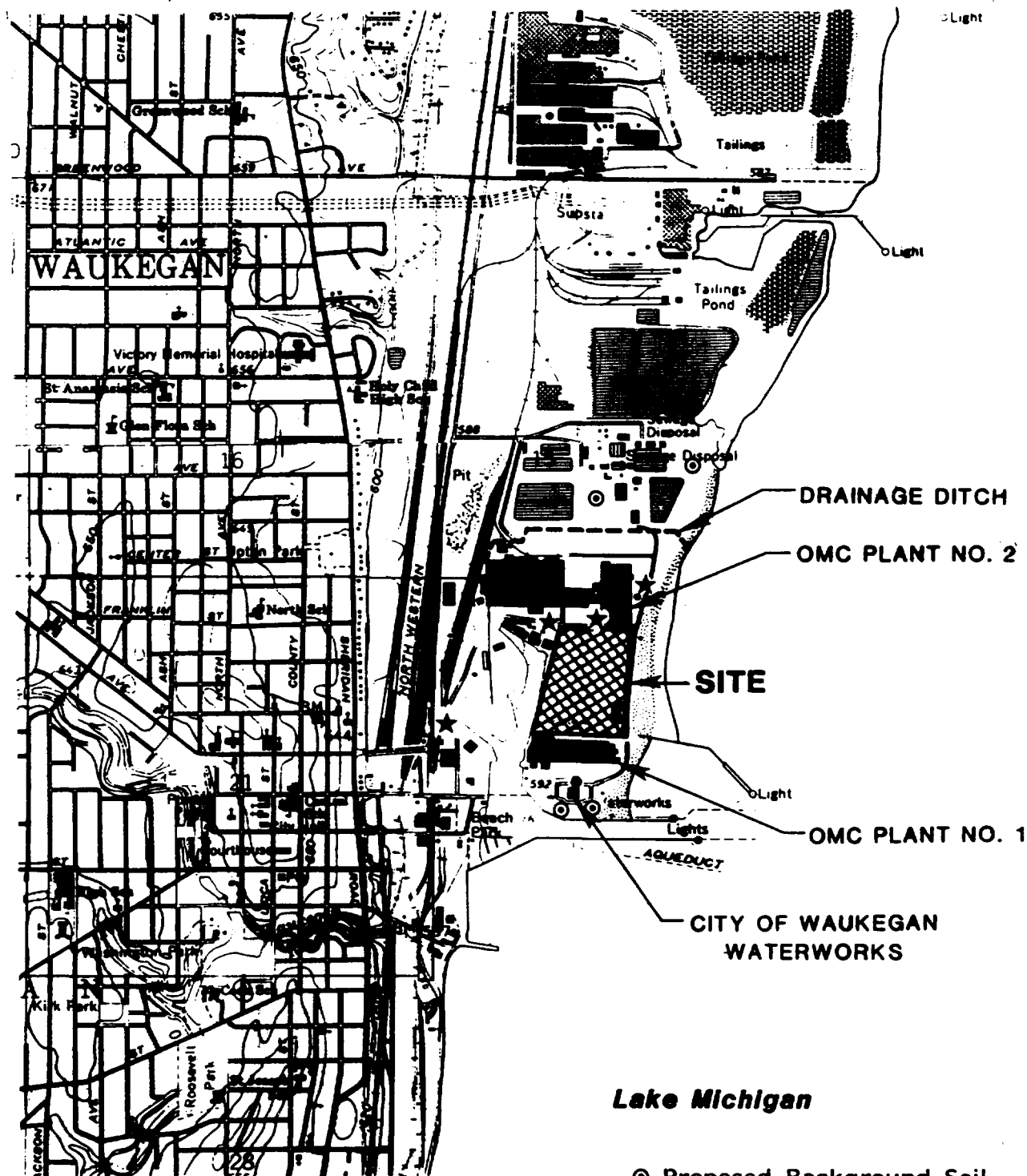


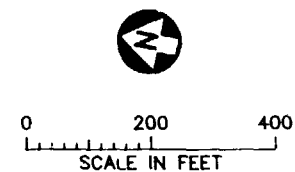
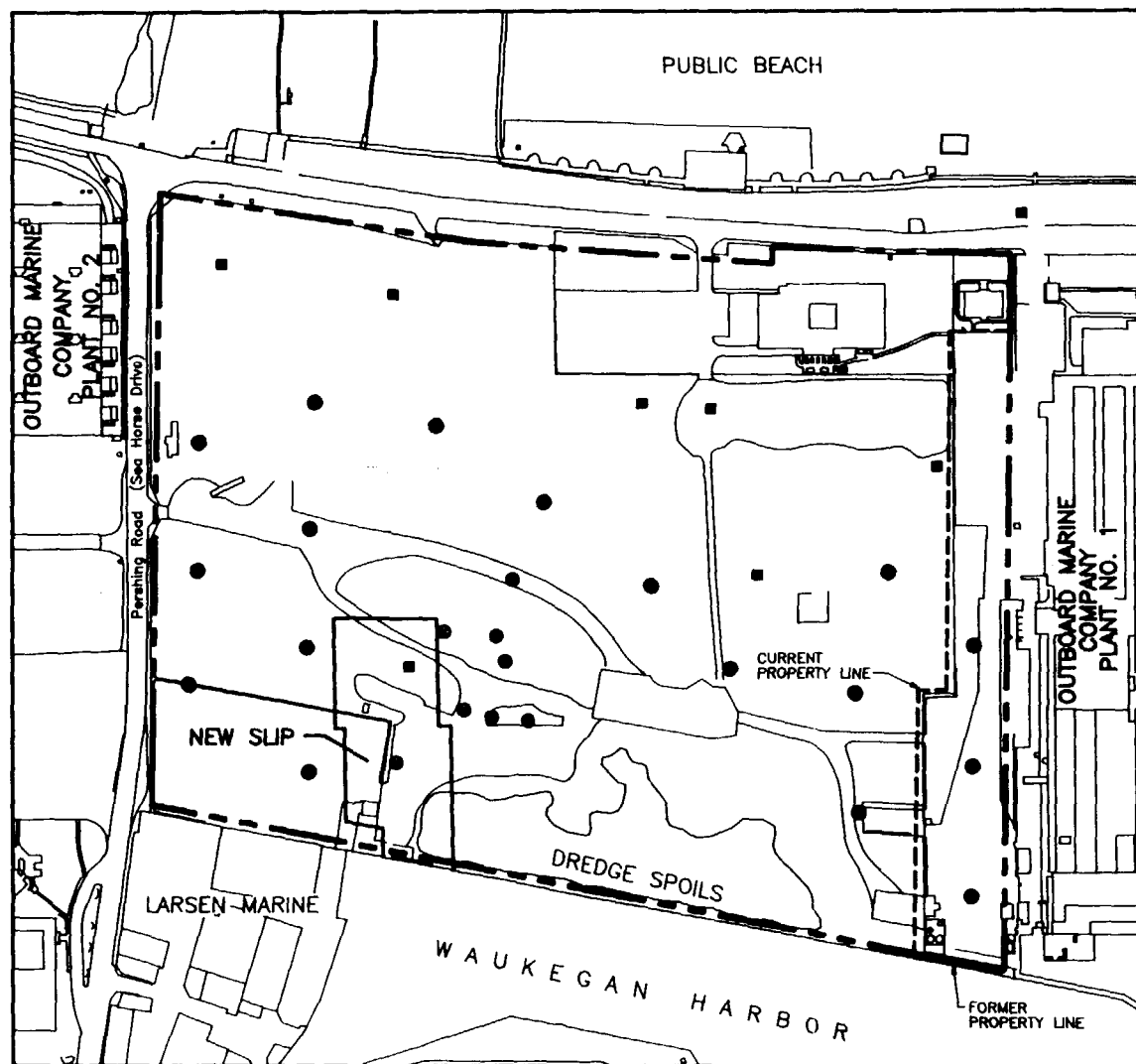
Figure 6.3-1  
PRELIMINARY SOURCE AREA  
CHARACTERIZATION



### Lake Michigan

- ⊙ Proposed Background Soil Sampling Location (Vicinity of Assumed Non-Industrial Operations)
- ★ Proposed Background Soil Sampling Location (Vicinity of Known Industrial Operations)

Figure 6.3-2  
PROPOSED BACKGROUND  
SOIL SAMPLING LOCATIONS



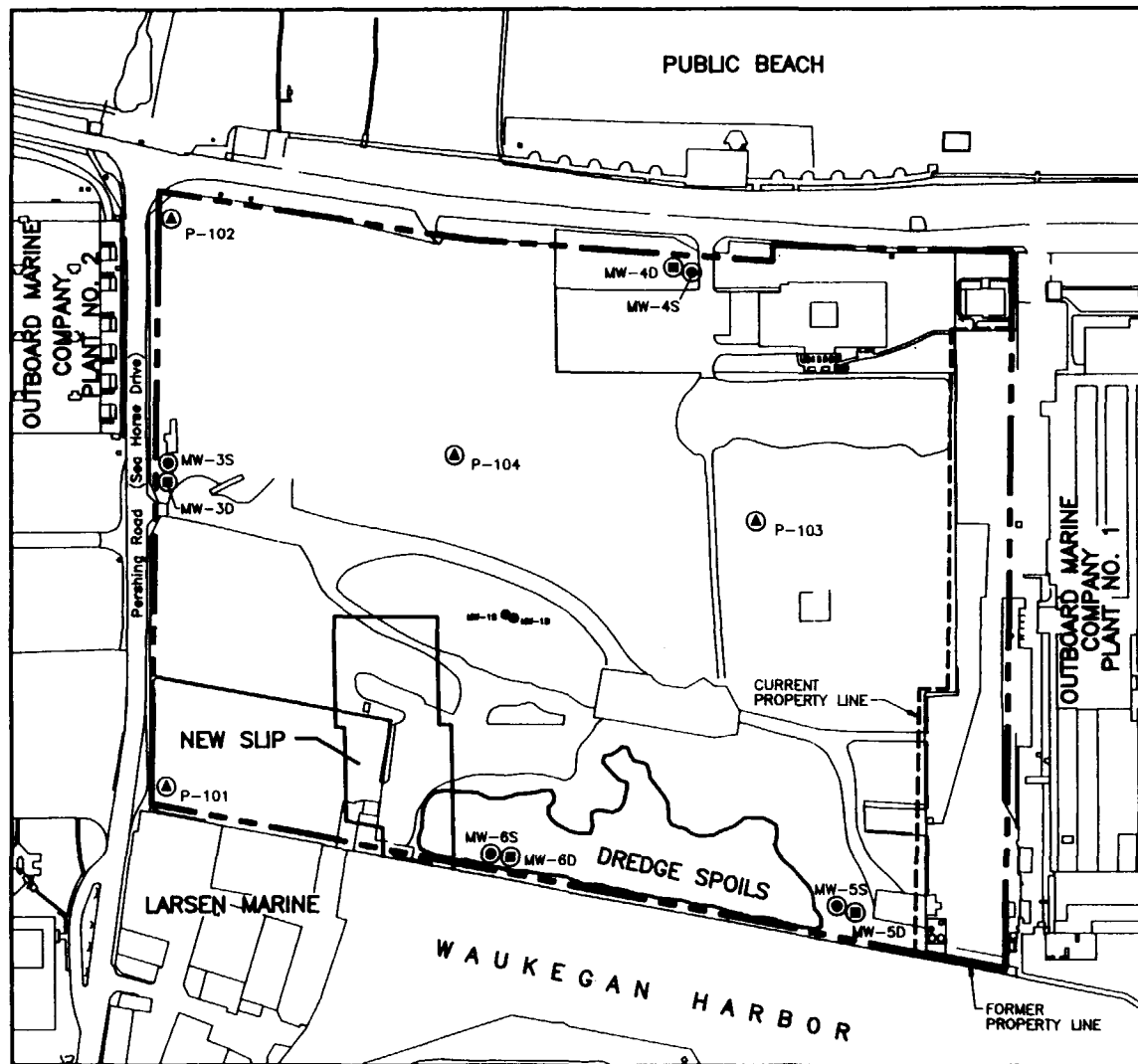
- - IEPA Soil Boring
- - Canonic/EPA Split Sample
- - Proposed Soil Sampling Location

Base Map and locations of existing facilities provided by OMC.

Approximate location of Wood Treating Plant determined from USACE Map, 1908, and Sanborn Fire Insurance Map, 1917.

Locations of Coke Plant Facilities from aerial photographs and Sanborn Fire Insurance Maps.

Figure 6.3-3  
PROPOSED  
SURFICIAL SOIL SAMPLING  
LOCATIONS



- 0 200 400  
SCALE IN FEET
- MW-55 ● - Proposed Water Table Monitoring Well  
 MW-50 ● - Proposed Pilot Boring/ Deep Monitoring Well  
 P-101 ▲ - Proposed Piezometer  
 MW-1S ● - Existing Monitoring Well

Figure 6.3-4  
PROPOSED  
PILOT BORING, MONITORING WELL,  
AND PIEZOMETER LOCATIONS

## ***Appendix A***

### ***New Slip Investigation Groundwater Quality Data***

10/18/83

11 44

L-10 120 100

COMPUCHEN # 922878 FILE: 92D92273ARO

SEMI-VOLATILE - LIQUID

COMPOUND LIST 1/0

PAGE 1

SAMPLE ID # MW-15 out well

CMF #	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETECT. LIMIT (UG/L)
494	182	1	D-1,4-DICHLOROBENZENE (180	376	102000	40.0	BDL
610	94		PHENOL (0103)				BDL
411	93		2,2-(2-CHLOROETHYL)ETHER (01				BDL
601	128		2-CHLOROPHENOL (0104)				BDL
421	146		1,2-DICHLOROBENZENE (0107)				BDL
422	146		1,3-DICHLOROBENZENE (0108)				BDL
474	108		BENZYL ALCOHOL (0109)				BDL
420	146		1,2-DICHLOROBENZENE (01010)				BDL
620	108		2-METHYLPHENOL (01011)				BDL
412	45		2,2-(2-CHLOROISOPROPYL)ETHER				BDL
622	108		4-METHYLPHENOL (01013)				BDL
442	70		N-NITROSO-DI-N-PROPYLAMINE				BDL
436	117		HEXACHLOROETHANE (01015)				BDL
440	77		NITROBENZENE (01016)				BDL
460	136	1	D-NAPHTHALENE (1802)	504	372000	40.0	BDL
438	82		ISOPHORONE (0202)				BDL
606	139		2-NITROPHENOL (0203)				BDL
603	107		2,4-DIMETHYLPHENOL (0204)				BDL
625	122		BENZOIC ACID (0205)				BDL
410	93		2,2-(2-CHLOROETHOXY)METHANE				BDL
602	162		2,4-DICHLOROPHENOL (0207)				BDL
446	180		1,2,4-TRICHLOROBENZENE (020			109.0	1100 D
439	128		NAPHTHALENE (0209)				BDL
475	127		4-CHLOROANILINE (02010)				BDL
434	228		1,2,3,4-TETRACHLOROBUTADIENE (02011)				BDL
608	107		1-CHLORO-N-CRESOL (02012)				BDL
477	142		2-METHYLNAPHTHALENE (02013)			5.2	82 D
198	164	1	DIO-ACENAPHTHENE (1803)	690	202000	40.0	BDL
435	236		HEXACHLOROCYCLOPENTADIENE (				BDL
611	196		2,4,6-TRICHLOROPHENOL (0303)				BDL
624	196		2,4,8-TRICHLOROPHENOL (0304)				BDL
416	162		2-CHLORONAPHTHALENE (0305)				BDL
478	65		2-NITROANILINE (0306)				BDL
428	163		DIMETHYL PHTHALATE (0307)				BDL
402	182		ACENAPHTHYLENE (0308)				BDL
479	138		3-NITROANILINE (0309)				BDL
401	182		ACENAPHTHENE (03010)			5.5	85 D
605	184		2,4-DINITROPHENOL (03011)				BDL
607	109		4-NITROPHENOL (03012)				BDL
476	168		DIBENZOFURAN (03013)			4.7	47J D
427	168		2,4-DINITROTOLUENE (03014)				BDL
428	168		2,6-DINITROTOLUENE (03015)				BDL
424	149		DIMETHYL PHTHALATE (03016)				BDL

CORRECTED/REVIEWED BY

J. Marshall  
(GC/MS DATA REVIEWER)

DATE

10-12-89

COMPUCHEN # 872878

FILE: 02D92275A80  
SEMI-VOLATILE - LIQUID

COMPOUND LIST 170

PAGE 2

MW-15

MP	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETECT. LIMIT (UG/L)
117	204	4-CHLOROPHENYL PHENYL ETHER				BDL	50
122	166	FLUORENE (03018)			4.3	43J D	50
180	138	4-NITROANILINE (03019)				BDL	250
167	188	1 DIO-PHENANTHRENE (1504)	845	338000	40.0		
104	178	4,4-DINITRO-2-METHYLPHENOL				BDL	250
143	169	N-NITROSODIPHENYLAMINE (040)				BDL	50
114	248	4-BROMOPHENYL PHENYL ETHER				BDL	50
133	254	HEXACHLOROBENZENE (0405)				BDL	50
109	266	PENTACHLOROPHENOL (0406)				BDL	250
144	178	PHENANTHRENE (0407)			3.8	38 AGJ D	50
103	178	ANTHRACENE (0408)			4.0	40 BDL	50
126	149	DIN-BUTYL PHTHALATE (0409)			4.0		50
131	202	FLUORANTHENE (0410)				BDL	50
109	240	1 D12-CHRYSENE (1505)	1127	240000	40.0		
145	202	PYRENE (0503)				BDL	50
113	149	BUTYLBENZYL PHTHALATE (0504)				BDL	50
123	252	3,3'-DICHLOROBENZIDINE (050)				BDL	100
105	278	BENZO(A)ANTHRACENE (0506)				BDL	50
113	149	BIS(2-ETHYLHEXYL) PHTHALATE				BDL	50
118	228	CHRYSENE (0508)				BDL	50
197	264	1 D12-PERYLENE (1506)	1268	213000	40.0		
129	149	DIN-OCTYL PHTHALATE (0602)				BDL	50
107	252	BENZO(B)FLUORANTHENE (0603)				BDL	50
109	252	BENZO(K)FLUORANTHENE (0604)				BDL	50
106	252	BENZO(A)PYRENE (0605)				BDL	50
137	276	INDENO(1,2,3-CD)PYRENE (06)				BDL	50
119	278	DIBENZO(A,H)ANTHRACENE (060)				BDL	50
108	276	BENZO(G,H,I)PERYLENE (0608)				BDL	50
119	112	2-FLUOROPHENOL (8801)			9.1	9.1 %	
112	99	DS-PHENOL (8802)			8.5	8.5 %	
147	82	DS-NITROBENZENE (8803)			7.0	70. %	
148	172	2-FLUOROBIPHENYL (8804)			6.5	65. %	
128	330	2,3,6-TRIBROMOPHENOL (8805)			10.8	84. %	
194	244	D12-TERPHENYL (8806)			8.0	80. %	
171	212	D10-PYRENE			8.3	83. %	
186	216	1,2,3,4-TETRACHLOROBENZENE				BDL	5.00
CHECKSUMS:			4810	1473000.	438.1	1849.	
13338.							

CORRECTED/REVIEWED BY

L. Herrell  
(GC/MS DATA REVIEWER)

DATE

10-18-87

10/19/89

17.45

0919 248 8788

CompuChem Corp.

00047001

COMPUCHEM # 272275

FILE: 02092875A20  
SEMI-VOLATILE - LIQUID

COMPOUND LIST 170

PAGE 3

MW 15

NO	CC ID#	SURROGATE COMPOUND	QUANT REPORT VALUE	QUANT REPORT AMOUNT SPIKED	% ++ RECOVERY	CONTROL RANGE	P	F
72	619	2-FLUOROPHENOL (SS#1)	9.1	20.0	46.	81-100	X	
73	612	D5-PHENOL (SS#2)	8.5	20.0	42.	10-94	X	
74	447	D5-NITROBENZENE (SS#3)	7.0	10.0	70.	35-114	X	
75	448	2-FLUOROBIPHENYL (SS#4)	6.5	10.0	65.	43-116	X	
76	628	2,4,6-TRIBROMOPHENOL (SS#5)	10.8	20.0	54.	10-123	X	
77	496	D12-TERPHENYL (SS#6)	8.0	10.0	80.	33-141	X	
78	471	D10-PYRENE	8.3	10.0	83.	40-130*	X	

\* ADVISORY SURROGATE ONLY

+ % RECOVERY = QUANT REPORT VALUE / QUANT REPORT AMOUNT SPIKED X 100 %

## CORRECTION FACTOR CALCULATION:

FINAL EXTRACT VOLUME (ML) 1000 ML X DILUTION FACTOR X 2 =  
 1.0ML FOR ACID & 1.0ML FOR BN VOL SAMPLE EXTRACTED (ML)

0.5ML 1000. ML X 5.0 X 2 = 10.000

1.0ML & 1.0ML 500. ML

QUANT REPORT AMOUNT SPIKED CONVERSION FACTOR:

1000 UL X FINAL EXTRACT VOL (ML) X DILUTION FACTOR X 2 =  
 AMOUNT SURROGATE ADDED (UL) 1.0ML FOR ACID & 1.0ML FOR BN

1000 UL 0.5ML X 5.0 X 2 = 10.000

500 UL 1.0ML & 1.0ML

VERSION 8

CORRECTED/REVIEWED BY

(GC/MS DATA REVIEWER)

DATE

10-12-89

10/19/89

17:45

0919 243 6766

CompuChem Corp.

10/19/89

COMPUCKEN 0 072274

FILE: 04092274820

COMPOUND LIST 170

PAGE 1

SEMI-VOLATILE - LIQUID

SAMPLE ID # MW-25 North Wall

MP	#	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETECT. LIMIT (UG/L)
194	152	1	1,4-DICHLOROBENZENE (0100)	387	88800	40.0		
110	94		PHENOL (0103)			1.2	RJ	10
111	93		BIS(2-CHLOROETHYL)ETHER (0104)				BDL	10
501	128		2-CHLOROPHENOL (0106)				BDL	10
421	146		1,2-DICHLOROBENZENE (0107)				BDL	10
422	146		1,3-DICHLOROBENZENE (0108)				BDL	10
474	108		BENZYL ALCOHOL (0109)				BDL	10
420	146		1,3-DICHLOROBENZENE (01010)			3.1	RJ	10
120	108		2-ETHYLPHENOL (01011)				BDL	10
412	48		BIS(2-CHLOROISOPROPYL)ETHER				BDL	10
522	108		4-ETHYLPHENOL (01013)				BDL	10
442	70		N-NITROSO-DI-N-PROPYLAMINE				BDL	10
434	117		HEXACHLOROETHANE (01015)				BDL	10
440	7		NITROBENZENE (01016)				BDL	10
460	154	1	1,8-NAPHTHALENE (0202)	818	326000	40.0		
438	102		ISOPHORONE (0202)				BDL	10
606	159		2-NITROPHENOL (0203)				BDL	10
603	157		2,4-DIMETHYLPHENOL (0204)			1.2	RJ	10
628	22		BENZOIC ACID (0205)			2.8	RJ	50
410	93		BIS(2-CHLOROETHOXY)METHANE				BDL	10
602	162		2,4-DICHLOROPHENOL (0207)				BDL	10
446	180		1,2,4-TRICHLOROBENZENE (0209)				BDL	10
439	128		NAPHTHALENE (0209)				BDL	10
478	127		4-CHLORANILINE (0210)				BDL	10
434	228		1,2,4-TRICHLOROBUTADIENE (0211)				BDL	10
608	107		P-CHLORO-M-CRESOL (0212)				BDL	10
477	142		2-METHYLNAPHTHALENE (0213)				BDL	10
498	164	1	DIO-ACENAPHTHENE (0303)	701	164000	40.0		
439	236		HEXACHLOROCYCLOPENTADIENE (				BDL	10
611	196		2,3,6-TRICHLOROPHENOL (0303)				BDL	10
626	196		2,3,5-TRICHLOROPHENOL (0304)				BDL	50
416	162		2-CHLORONAPHTHALENE (0305)				BDL	50
478	68		2-NITROANILINE (0306)				BDL	10
428	163		DIMETHYL PHTHALATE (0307)				BDL	10
402	152		ACENAPHTHYLENE (0308)				BDL	10
479	138		3-NITROANILINE (0309)				BDL	50
401	153		ACENAPHTHENE (0310)				BDL	10
608	184		2,4-DINITROPHENOL (0311)				BDL	50
607	109		4-NITROPHENOL (0312)				BDL	50
476	168		DIBENZOFURAN (0313)				BDL	10
427	168		2,4-DINITROTOLUENE (0314)				BDL	10
428	169		2,5-DINITROTOLUENE (0315)				BDL	10
424	149		DIMETHYL PHTHALATE (0316)				BDL	10

CORRECTED/REVIEWED BY

(90/MS DATA REVIEWER)

DATE

10-11-89

MW-2S

CHP #	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETECT. LIMIT (UG/L)
417	204	4-CHLOROPHENYL PHENYL ETHER				BDL	10
432	166	FLUORENE (0301-8)				BDL	10
450	138	4-NITROANILINE (03619)				BDL	50
467	188	1-DIPHENANTHRENE (1841)	856	247000	40.0		
604	198	4,6-DINITRO-2-METHYLPHENOL				BDL	50
443	169	N-NITROSODIPHENYLAMINE (040				BDL	10
414	248	4-BROMOPHENYL PHENYL ETHER				BDL	10
433	284	HEXACHLOROBENZENE (0408)				BDL	10
609	266	PENTACHLOROPHENOL (0406)				BDL	50
444	178	PHENANTHRENE (0407)				BDL	10
403	178	ANTHRACENE (0408)				BDL	10
426	149	DIM-BUTYL PHTHALATE (0409)				BDL	10
431	202	FLUORANTHENE (04010)				BDL	10
59	240	1-D8-CHRYSENE (1808)	1140	131000	40.0		
448	202	PYRENE (0503)				BDL	10
415	149	BUTYLBENZYL PHTHALATE (0504				BDL	10
423	282	3,3'-DICHLOROBENZIDINE (050				BDL	20
408	278	BENZO(A)ANTHRACENE (0506)				BDL	10
413	149	BIS(2-ETHYLHEXYL) PHTHALATE				BDL	10
418	228	CHRYSENE (0508)				BDL	10
497	244	1-D8-PERYLENE (1846)	1282	147000	40.0		
429	149	DIM-N-OCTYL PHTHALATE (0602)				BDL	10
407	282	BENZO(B)FLUORANTHENE (0603)				BDL	10
409	282	BENZO(K)FLUORANTHENE (0604)				BDL	10
406	282	BENZO(A)PYRENE (0605)				BDL	10
437	276	INDENO(1,2,3-CD)PYRENE (06				BDL	10
419	278	DIBENZO(A,H)ANTHRACENE (060				BDL	10
408	276	BENZO(G,H,I)PERYLENE (0608)				BDL	10
619	112	2-FLUOROPHENOL (8801)			70.6	71.7	
612	99	05-PHENOL (8802)			57.8	58.7	
17	82	05-NITROBENZENE (8803)			39.3	79.7	
448	172	2-FLUOROBIPHENYL (8804)			51.6	103.7	
628	330	2,3,6-TRIBROMOPHENOL (8805)			117.0	117.7	
496	244	D,3-TERPHENYL (8806)			69.9	140.7	
471	212	D,0-PYRENE			60.3	121.7	
456	216	1,2,3,4-TETRACHLOROBENZENE				BDL	1.00
CHECKSUMS:			4881	1105800.	716.7		708.
13335.							

CORRECTED/REVIEWED BY                       
(GC/MS DATA REVIEWER)DATE 10/18/88

MW-25

CC	ID#	SURROGATE COMPOUND	QUANT REPORT VALUE	QUANT REPORT AMOUNT SPIKED	% ++ RECOVERY	CONTROL RANGE	P	F
2	419	2-FLUOROPHENOL (SS01)	70.6	100.0	71.	21-100	X	
3	412	D5-PHENOL (SS02)	57.8	100.0	58.	10-94	X	
4	447	D5-NITROBENZENE (SS03)	89.3	50.0	79.	35-114	X	
5	448	2-FLUOROBIPHENYL (SS04)	51.6	50.0	103.	43-116	X	
6	428	2,4,6-TRISBROMOPHENOL (SS05)	117.0	100.0	117.	10-123	X	
7	496	D10-TERPHENYL (SS06)	69.9	50.0	140.	33-141	X	
8	471	D10-PYRENE	60.3	50.0	121.	40-130	X	

\* ADVISORY SURROGATE ONLY

+ % RECOVERY = QUANT REPORT VALUE / QUANT REPORT AMOUNT SPIKED X 100 %

DILUTION FACTOR CALCULATION:

FINAL EXTRACT VOLUME (ML) 1000 ML DILUTION  
 \_\_\_\_\_ X \_\_\_\_\_ FACTOR X 2 =  
 0.5 ML FOR ACID & 1.0 ML FOR BN VOL SAMPLE EXTRACTED (ML)

0.5 ML 1000 ML 1.0  
 \_\_\_\_\_ X \_\_\_\_\_ X \_\_\_\_\_ X 2 = 2.000

1.0 ML & 1.0 ML 500 ML

QUANT REPORT AMOUNT SPIKED CONVERSION FACTOR:

500 UL FINAL EXTRACT VOL (ML) GC 1  
 \_\_\_\_\_ X \_\_\_\_\_ X DILUT N X 2 =  
 AMOUNT SURROGATE ADDED (UL) 1.0 ML FOR ACID & 1.0 ML FOR BN FACT

500 UL 0.5 ML 1.0  
 \_\_\_\_\_ X \_\_\_\_\_ X \_\_\_\_\_ X 2 = 2.000

500 UL 1.0 ML & 1.0 ML

VERSION 8

CORRECTED/REVIEWED BY Joe. Smith  
 (GC/MS DATA REVIEWER)

DATE 10-11-03

10/20/89

12:38

0919 248 8788

CompuChem Corp.

COMPUCHEM # D92373

FILE: 09D9E273807

COMPOUND LIST 170

PAGE 1

SEMI-VOLATILE - LIQUID

ID# MW-2D

CHP #	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETECT. LIMIT (UG/L)
494	182	I D4-1,4-DICHLOROBENZENE (18#)	513	97100	40.0		
510	94	PHENOL (Q1#3)			76.4	76000 D	5000
411	93	815 2-CHLOROETHYL)ETHER (Q1				BDL	5000
601	128	2-CHLOROPHENOL (Q1#6)				BDL	5000
421	146	1,3-DICHLOROBENZENE (Q1#7)				BDL	5000
422	146	1,4-DICHLOROBENZENE (Q1#8)				BDL	5000
474	108	BENZYL ALCOHOL (Q1#9)				BDL	5000
420	146	1,2-DICHLOROBENZENE (Q1#10)				BDL	5000
520	108	2-METHYLPHENOL (Q1#11)			7.3	7300 D	5000
412	45	815 2-CHLOROISOPROPYL)ETHER				BDL	5000
422	108	4-METHYLPHENOL (Q1#13)			44.4	44000 D	5000
442	70	N-NITROSO-DI-N-PROPYLAMINE				BDL	5000
436	117	HEXACHLOROETHANE (Q1#15)				BDL	5000
440	77	NITROBENZENE (Q1#16)				BDL	5000
460	136	I D8-NAPHTHALENE (15#2)	629	293000	40.0		
438	82	ISOPHORONE (Q2#2)				BDL	5000
606	139	2-NITROPHENOL (Q2#3)				BDL	5000
603	107	2,4-DIMETHYLPHENOL (Q2#4)			3.1	3100 D	5000
625	122	BENZOIC ACID (Q2#8)			<del>10.5</del>	<del>10000</del> BDL	25000
410	93	815 2-CHLOROETHOXY)METHANE				BDL	5000
502	162	2,4-DICHLOROPHENOL (Q2#7)				BDL	5000
446	180	1,2,4-TRICHLOROBENZENE (Q2#				BDL	5000
439	128	NAPHTHALENE (Q2#9)				BDL	5000
475	127	4-CHLOROANILINE (Q2#10)				BDL	5000
434	225	HEXACHLOROBUTADIENE (Q2#11)				BDL	5000
508	107	P-CHLORO-M-CRESOL (Q2#12)				BDL	5000
477	142	2-METHYLNAPHTHALENE (Q2#13)				BDL	5000
95	164	I D10-ACENAPHTHENE (18#3)	797	131000	40.0		
435	237	HEXACHLOROCYCLOPENTADIENE (				BDL	5000
611	196	2,4,6-TRICHLOROPHENOL (Q3#3)				BDL	5000
626	196	2,4,5-TRICHLOROPHENOL (Q3#4)				BDL	25000
414	162	2-CHLORONAPHTHALENE (Q3#5)				BDL	5000
478	66	2-NITROANILINE (Q3#6)				BDL	25000
425	163	DIMETHYL PHTHALATE (Q3#7)				BDL	5000
402	182	ACENAPHTHYLENE (Q3#8)				BDL	5000
479	138	3-NITROANILINE (Q3#9)				BDL	25000
401	187	ACENAPHTHENE (Q3#10)				RTN	5000
505	184	2,4-DINITROPHENOL (Q3#11)				BDL	25000
507	109	4-NITROPHENOL (Q3#12)			<del>2.5</del>	<del>20000</del> BDL	25000
476	168	DIBENZOFURAN (Q3#13)				BDL	5000
427	165	2,4-DINITROTOLUENE (Q3#14)				BDL	5000
428	165	2,6-DINITROTOLUENE (Q3#15)				BDL	5000
424	149	DIETHYL PHTHALATE (Q3#16)				BDL	5000

CORRECTED/REVIEWED BY

(GC/MS DATA REVIEWER)

PRELIMINARY RESULTS  
SUBJECT TO FINAL TECHNICAL REVIEW

DATE

10-19-89

IT + mw-20

五

100

**COMPOUND NAME**

**2000**

QUANT	REPORT	VALUE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

REPORT	AMOUNT	(USD/L)
1000	1000	1000
2000	2000	2000
3000	3000	3000
4000	4000	4000
5000	5000	5000
6000	6000	6000
7000	7000	7000
8000	8000	8000
9000	9000	9000
10000	10000	10000

DETECT.  
LIMIT  
(UG/L)

17	204	4-CHLOROPHENYL PHENYL ETHER				BDL	5000
32	166	FLUORENE (Q3#18)				BDL	8000
80	138	4-NITROANILINE (Q3#19)				BDL	25000
67	188	1-DICHLOROPHENANTHRENE (I8#4)	939	179000	40.0		
04	198	4,4-DINITRO-2-METHYLPHENOL				BDL	28000
43	169	4-NITRO-2-AMINOPHENYLAMINE (Q4#)				BDL	5000
14	248	4-BROMOPHENYL PHENYL ETHER				BDL	5000
33	284	HEXACHLOROBENZENE (Q4#5)				BDL	5000
09	266	PENTACHLOROPHENOL (Q4#6)				BDL	25000
44	178	PHENANTHRENE (Q4#7)				BDL	5000
03	178	ANTHRACENE (Q4#8)				BDL	5000
26	149	DI-N-BUTYL PHTHALATE (Q4#9)				BDL	5000
31	202	FLUORANTHENE (Q4#10)				BDL	5000
59	240	1-DICHLOROBENZENE (I8#5)	1208	36000	40.0	BDL	50
43	202	PYRENE (Q5#3)				BDL	5000
13	149	BUTYLBENZYL PHTHALATE (Q5#4)				BDL	5000
23	252	3,3'-DICHLOROBENZIDINE (Q5#)				BDL	10000
05	228	BENZIDINE (Q5#6)				BDL	5000
13	149	BIS(2-ETHYLHEXYL) PHTHALATE				BDL	5000
18	228	CHRYSENE (Q5#8)				BDL	5000
37	264	1-DICHLOROPERYLENE (I8#6)	1463	29300	40.0		
29	149	DI-N-OCTYL PHTHALATE (Q6#2)				BDL	5000
37	252	BENZIDINE (Q6#3)				BDL	5000
39	252	BENZIDINE (Q6#4)				BDL	5000
36	282	BENZIDINE (Q6#5)				BDL	5000
37	276	INDENO(1,2,3-C,D)PYRENE (Q6#)				BDL	5000
19	278	DIBENZO(A,H)ANTHRACENE (Q6#)				BDL	5000
08	276	BENZIDINE (Q6#8)				BDL	5000
19	112	2-FLUOROPHENOL (88#1)			0.0	BDL	5000
12	99	5-FLUOROPHENOL (88#2)			0.0		
17	82	5-NITROBENZENE (88#3)			0.0		
18	172	2-FLUOROBIPHENYL (88#4)			0.0		
18	330	2,4-DIBROMOPHENOL (88#5)			0.0		
36	244	8-TERPENE (88#6)			0.0		
11	212	8-PYRENE			0.0		
36	216	3,4-TETRACHLOROBENZENE			0.0	BDL	500

13336

13336

**பெயர்:**

**SECRET**

**PRELIMINARY RESULTS  
SUBJECT TO FINAL TECHNICAL REVIEW**

CORRECTED/REVIEWED BY

*[Signature]*  
GC/MS DATA REVIEWER

DATE \_\_\_\_\_

10-19-89

10/20/89

12:37

DB 5 240 0700

COMPUCHER CORP.

COMPUCHER # 092273

FILE: 05092273807

COMPOUND LIST 170

PAGE 3

BEMI-VOLATILE - LIQUID

ID# MW-2D

NO	CC	ID#	SURROGATE COMPOUND	QUANT REPORT VALUE	QUANT REPORT AMOUNT SPIKED	% ++ RECOVERY	CONTROL RANGE	P	F
72	619	2-F	LUOROPHENOL (BB#1)	NOT FOUND			21-100		X
73	612	D5-	PHENOL (BB#2)	NOT FOUND			10-94		X
74	447	D5-	NITROBENZENE (BB#3)	NOT FOUND			35-114		X
75	448	2-F	LUOROBIPHENYL (BB#4)	NOT FOUND			43-116		X
76	628	2,4	6-TRIBROMOPHENOL (BB#5)	NOT FOUND			10-123		X
77	496	D14	-TERPHENYL (BB#6)	NOT FOUND			33-141		X
78	471	D10	-PYRENE	NOT FOUND			40-130*		X

\* ADVISORY SURROGATE ONLY

++ % RECOVERY = QUANT REPORT VALUE / QUANT REPORT AMOUNT SPIKED X 100 %

## CORRECTION FACTOR CALCULATION:

FINAL EXTRACT VOLUME (ML) 1000 ML DILUTION  
 ----- X ----- X -----  
 1.0ML FOR ACID & 1.0ML FOR BN VOL SAMPLE EXTRACTED (ML) FACTOR X 2 =

0.5ML 1000. ML \*500  
 ----- X ----- X -----  
 1.0ML & 1.0ML 500. ML X 2 = \*1000.0

## QUANT REPORT AMOUNT SPIKED CONVERSION FACTOR:

1000 UL FINAL EXTRACT VOL (ML) 0CM5  
 ----- X ----- X -----  
 AMOUNT SURROGATE ADDED (UL) 1.0ML FOR ACID & 1.0ML FOR BN DILUTION X 2 =  
FACTOR

1000 UL 0.5ML \*500  
 ----- X ----- X -----  
 500 UL 1.0ML & 1.0ML X 2 = \*1000.0

VERSION 8

PRELIMINARY RESULTS  
 SUBJECT TO FINAL TECHNICAL REVIEW

CORRECTED/REVIEWED BY

(QC/MS DATA REVIEWER)

DATE

10-19-89

QUALITY ASSURANCE NOTICE

ConcChen 0 292273

Client ID 0 MW-20

Case 17444.124

A dilution of the SV fraction of this sample was required in order to achieve accurate and discernable results by GC/MS analysis (usually to prevent detector saturation). As a result, detection limits are elevated. While surrogate compounds may be diluted to concentrations below these limits, in such cases, surrogate recovery data cannot be calculated.

data reviewer

date

L. Merrill (1712)  
10-9-89

3408  
17083

COMPUCHEN

D92268

FILE: 03D92268A20  
SEMI-VOLATILE - LIQUID

COMPOUND LIST 1/0

PAGE

ID# MW-10

CHP #	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETE LIM (UG/L)
494	152	1,4-DICHLOROBENZENE (0100)	385	94300	40.0		
610	94	PHENOL (0103)			D 159.0	160000	
411	93	1-(2-CHLOROETHYL)ETHER (0104)				BDL	
601	128	2-CHLOROPHENOL (0106)				BDL	
421	146	1,3-DICHLOROBENZENE (0107)				BDL	
422	146	1,4-DICHLOROBENZENE (0108)				BDL	
474	108	BENZYL ALCOHOL (0109)				BDL	
420	146	1,2-DICHLOROBENZENE (0110)				BDL	
620	108	1-METHYLPHENOL (0111)			D 26.8	27000	
412	45	1-(2-CHLOROISOPROPYL)ETHER				BDL	
622	108	1-METHYLPHENOL (0113)			D 100.0	100000	
440	74	NITROGEN D1-M. PERFLUORINE				BDL	
436	117	1,1-DICHLOROETHANE (0118)				BDL	
440	77	1,1-DIBROMOETHANE (0116)				BDL	
460	136	1-NAPHTHALENE (1502)	514	326000	40.0		
438	82	1,1-DIBROMOETHANE (0202)				BDL	
606	139	1-NITROPHENOL (0203)				BDL	
603	107	1,4-DIMETHYLPHENOL (0204)			D 9.0	9000	
625	122	BENZOIC ACID (0205)			20.1	20000	
410	93	1-(2-CHLOROETHOXY)METHANE				BDL	
602	162	1,4-DICHLOROPHENOL (0207)				BDL	
444	180	1,2,4-TRICHLOROBENZENE (0208)				BDL	
439	128	1-NAPHTHALENE (0209)				BDL	
475	127	1-CHLORODANILINE (0210)				BDL	
424	225	1,1,1-TRICHLOROETHANE (0211)				BDL	
608	107	1-CHLORO-2-M-CRESOL (0212)				BDL	
477	142	1-METHYLNAPHTHALENE (0213)				BDL	
495	164	1,10-ACENAPHTHENE (1503)	700	158000	40.0		
435	236	1,1,1,1,2,2,3,3-HEPTACHLOROCYCLOPENTADIENE (				BDL	
611	196	2,4,6-TRICHLOROPHENOL (0303)				BDL	
626	196	2,4,6-TRICHLOROPHENOL (0304)				BDL	
416	162	2-CHLORONAPHTHALENE (0305)				BDL	
478	65	2-NITROANILINE (0306)				BDL	
429	163	1,1-DIMETHYL PHTHALATE (0307)				BDL	
402	182	1-ACENAPHTHYLENE (0308)				BDL	
479	138	3-NITROANILINE (0309)				BDL	
401	183	1-ACENAPHTHENE (0310)				BDL	
609	184	2,4-DINITROPHENOL (0311)				BDL	
607	109	4-NITROPHENOL (0312)				BDL	
476	168	1,2,3,4-TETRAHYDRO-2H-PYRAN (0313)				BDL	
427	165	2,4-DINITROTOLUENE (0314)				BDL	
428	168	2,6-DINITROTOLUENE (0315)				BDL	
424	149	1,1-DIMETHYL PHTHALATE (0316)				BDL	

CORRECTED/REVIEWED BY

(GC/MS DATA REVIEWER)

PRELIMINARY RESULTS  
SUBJECT TO FINAL TECHNICAL REVIEW

DATE

10/19/89

ID# MW-10

CMF	M/E F	COMPOUND NAME	SCAN	AREA	QUANT REPORT VALUE	REPORTED AMOUNT (UG/L)	DETEC LIMIT (UG/L)
417	204	1-CHLOROPHENYL PHENYL ETHER					
432	166	FLUORENE (03018)				BDL	5
450	138	1-NITROANILINE (03019)				BDL	5
467	188	10-PHENANTHRENE (18041)	858	280000	40.0	BDL	25
604	198	1,4-DINITRO-2-METHYLPHENOL					
443	169	1-NITROBODIPHENYLAMINE (040				BDL	25
414	248	1-BROMOPHENYL PHENYL ETHER				BDL	5
433	284	1,2-DICHLOROBENZENE (0405)				BDL	5
609	266	1,2,3,4-TETRACHLOROPHENOL (0406)				BDL	5
444	178	1-PHENANTHRENE (0407)				BDL	25
403	178	1-ANTHRACENE (0408)				BDL	5
426	149	1,1-N-BUTYL PHTHALATE (0409)				BDL	5
431	202	1-FLUORANTHENE (0410)				BDL	5
439	240	1,12-CHRYSENE (1805)	1138	158000	40.0	BDL	50
445	202	1-PYRENE (0503)					
415	149	1-UTYLBENZYL PHTHALATE (0504)				BDL	50
423	252	1,3'-DICHLOROBENZIDINE (050				BDL	50
405	228	1-BENZO(A)ANTHRACENE (0506)				BDL	100
413	149	1,18(2-ETHYLHEXYL) PHTHALATE				BDL	50
418	228	1-CHRYSENE (0508)				BDL	50
497	264	1,12-PERYLENE (1806)	1281	158000	40.0	BDL	50
429	149	1,1-N-OCTYL PHTHALATE (0502)					
407	252	1-BENZO(B)FLUORANTHENE (0603)				BDL	50
409	252	1-BENZO(K)FLUORANTHENE (0604)				BDL	50
404	252	1-BENZO(A)PYRENE (0605)				BDL	50
437	276	1-BENZO(1,2,3-C,D)PYRENE (06				BDL	50
419	278	1-BENZO(A,H)ANTHRACENE (060				BDL	50
408	276	1-BENZO(G,H,I)PERYLENE (0608)				BDL	50
619	112	1,2-FLUOROPHENOL (8801)				BDL	50
612	99	1,3-PHENOL (8802)			0.0	0.0	
447	82	1,4-NITROBENZENE (8803)			0.0	0.0	
448	172	1,2-FLUOROBIPHENYL (8804)			0.0	0.0	
628	330	1,2,4,6-TRIBROMOPHENOL (8805)			0.0	0.0	
496	244	1,2,4-TERPHENYL (8806)			0.0	0.0	
471	212	1,10-PYRENE			0.0	0.0	
456	216	1,2,3,4-TETRACHLOROBENZENE			0.0	0.0	
CHECKSUMS:							
1333							
4873 1144300. 554.9 316000.							

PRELIMINARY RESULTS  
SUBJECT TO FINAL TECHNICAL REVIEWCORRECTED/REVIEWED BY                       
(QC/MS DATA REVIEWER)DATE 10/19/77

IB# MW-10

NO	CC ID#	ORRODATE COMPOUND	QUANT REPORT VALUE	QUANT REPORT AMOUNT SPIKED	% ++ RECOVERY	CONTROL RANGE
72	619	2-FLUOROPHENOL (8801)	NOT FOUND			21-100
73	612	3-PHENOL (8802)	NOT FOUND			10-94
74	447	3-NITROBENZENE (8803)	NOT FOUND			35-114
75	448	2-FLUOROETHYLPHENYL (8804)	NOT FOUND			43-116
76	628	2,4,6-TRIBROMOPHENOL (8805)	NOT FOUND			10-123
77	496	14-TERPHENYL (8806)	NOT FOUND			33-141
78	471	10-PYRENE	NOT FOUND			40-130*

\* ADVISORY SURROGATE ONLY

++ X RECOVERY = QUANT REPORT VALUE / QUANT REPORT AMOUNT SPIKED X 100 %

## CORRECTION FACTOR CALCULATION:

FINAL EXTRACT VOLUME (ML) 1000 ML DILUTION  
 ----- X ----- X ----- X 2 =  
 1.0ML FOR ACID & 1.0ML FOR BN VOL SAMPLE EXTRACTED (ML) FACTOR

0.5ML 1000. ML \*500  
 ----- X ----- X ----- X 2 = \*1000.0 ✓  
 1.0ML & 0.5ML 500. ML

## QUANT REPORT AMOUNT SPIKED CONVERSION FACTOR:

1000 UL FINAL EXTRACT VOL (ML) GCMS  
 ----- X ----- X ----- X DILUTION X 2 =  
 AMOUNT SURROGATE ADDED (UL) 1.0ML FOR ACID & 1.0ML FOR BN FACTOR

1000 UL 0.5ML \*500  
 ----- X ----- X ----- X 2 = \*1000.0  
 500 UL 1.0ML & 1.0ML

VERSION 1

PRELIMINARY RESULTS  
 SUBJECT TO FINAL TECHNICAL REVIEW

CORRECTED/REVIEWED BY

(GC/MS DATA REVIEWER)

DATE

6/19/85

## LABORATORY NOTICE

CompuChem ID# 292268 Client ID# MW-10

Matrix Spike (MS) 292269

Matrix Spike Duplicate (MSD) 292270

Blank Spike (BS) 292271

Case: 17444-124

Method: Semivolatile

Matrix: Liquid

The surrogate d5-phenol failed recovery criteria in both the original and the MS/MSD. Due to the very high concentrations of several TCL compounds, all three samples were analyzed at both 10:1 and 500:1 dilutions. At the 500:1 dilution level, phenol and 4-methylphenol were still outside of the instrument's analytical range in the MS and MSD. Further dilution was not performed since the original sample met the dilution criteria.

A blank spike, extracted at the same time as the sample spikes and original sample, was analyzed and met all QC criteria for spike and surrogate compound recoveries.

We are reporting the 500:1 dilution analysis data from all three sample and also the 10:1 dilution data of original sample.

*EL* *10/19/89*  
ELSI S. BYRD, Employee I.D. #624  
Sr. GC/MS Semivolatile Data Reviewer  
10/19/89

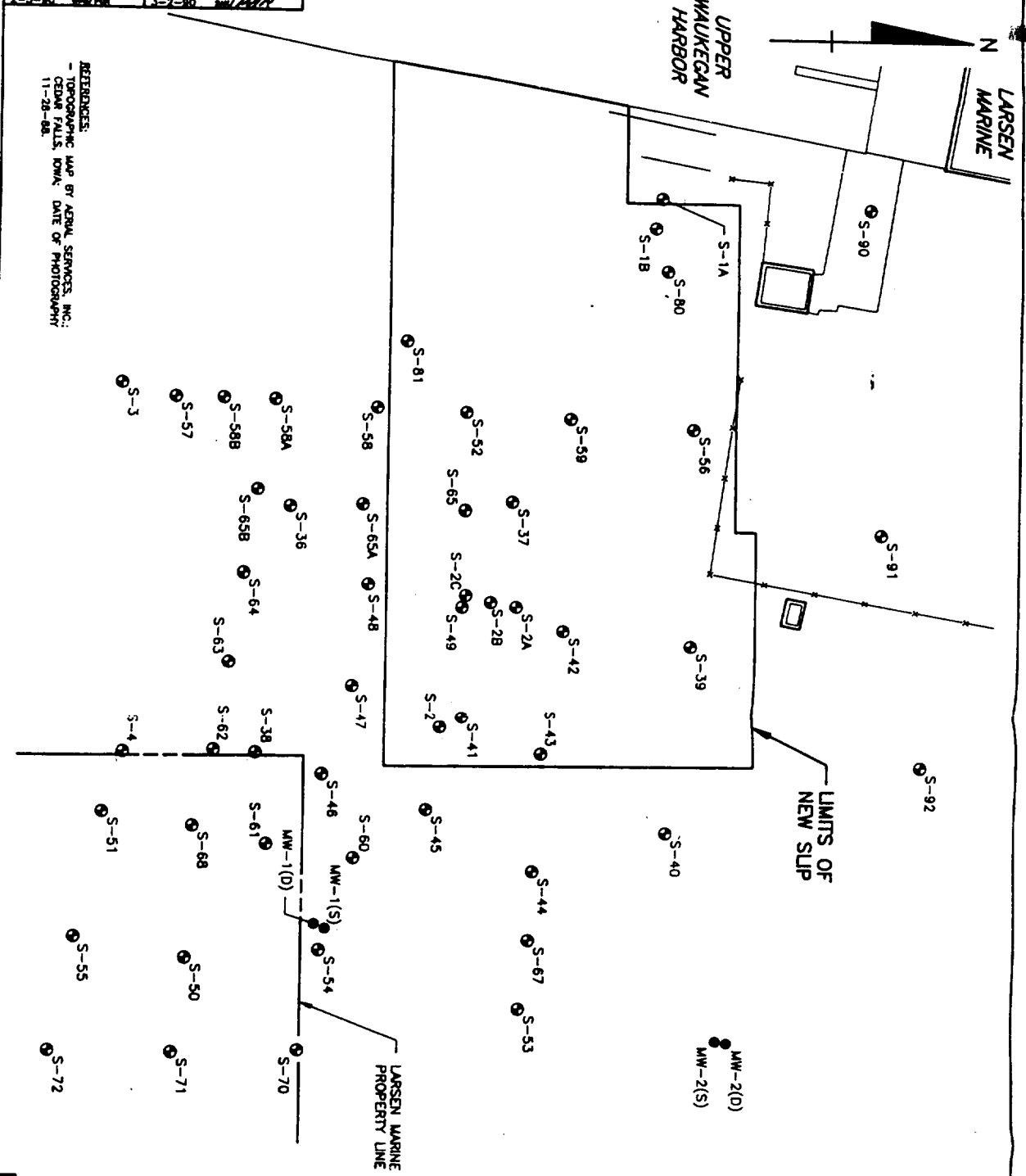
QA Approval #66  
Robert J. Whitehead  
Manager, Quality Assurance  
10/19/89

## ***Appendix A***

### ***New Slip Investigation Soil Quality Data***

*1989 Investigation*

REVISIONS		NO.	DATE	REASON FOR CHG.	BY	DATE	REASON FOR CHG.	BY	DRAWN BY	SAK	CHECKED BY	APPROVED BY	DRAWING NUMBER
2-5-80		1	12-15-88	REVISION FOR GPM/CLERK REVIEW	SAK	12-13-89	REVISION FOR GPM/CLERK REVIEW	SAK	12-13-89	12-13-89	12-13-89	12-13-89	87-126-8152



**LEGEND:**

--- FENCE

● MW-2(0) MONITORING WELL

● S-1A SOIL BORING



**Drift**

**Canone Environmental**

PREPARED FOR

WAUKEGAN HARBOR TRUST

NEW SLIP AREA

WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

DATE: 12-13-88

FIGURE 1

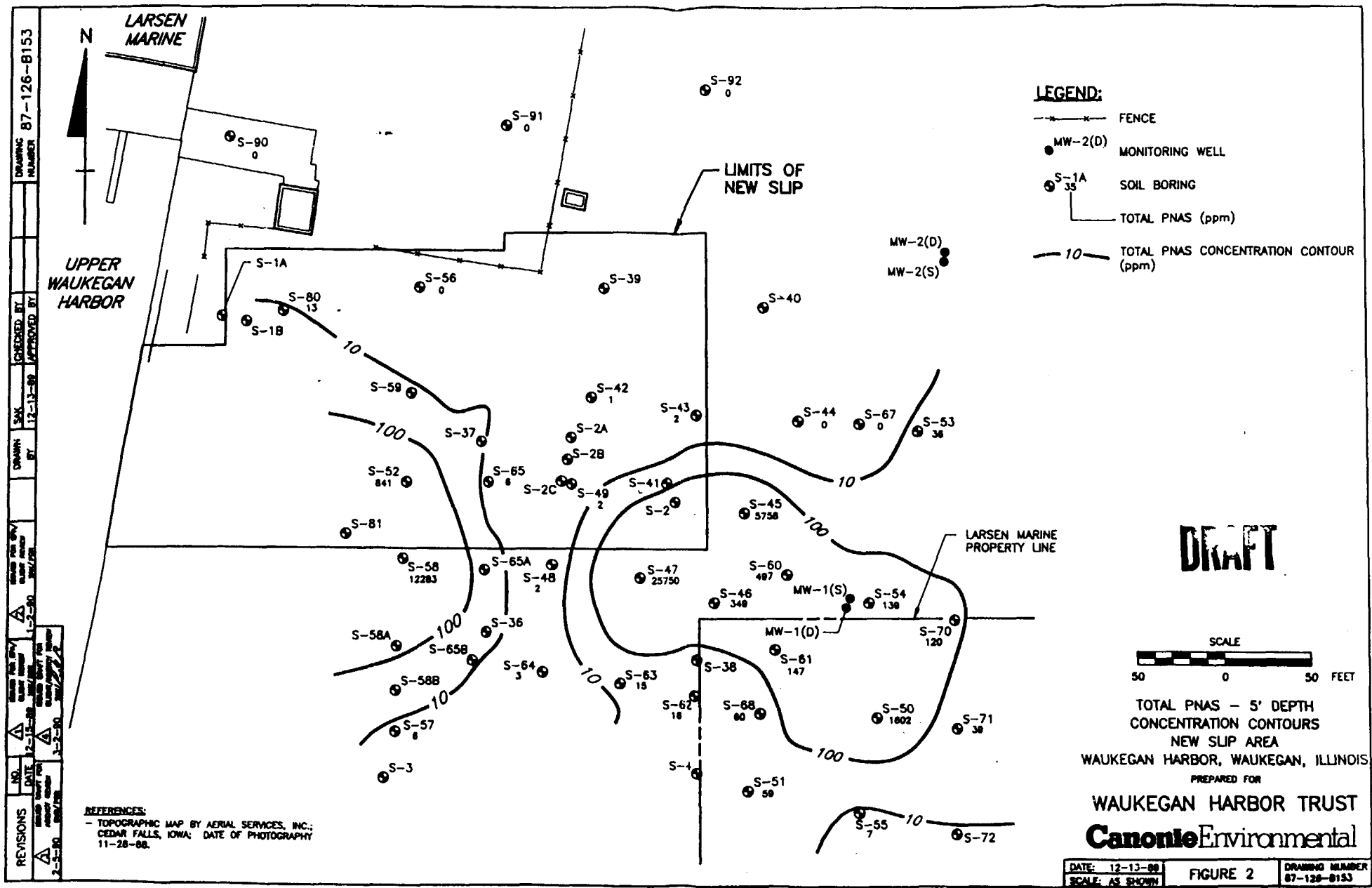
DRAWING NUMBER 87-126-8152

REFERENCES:

- TOPOGRAPHIC MAP BY AERIAL SERVICES, INC.:

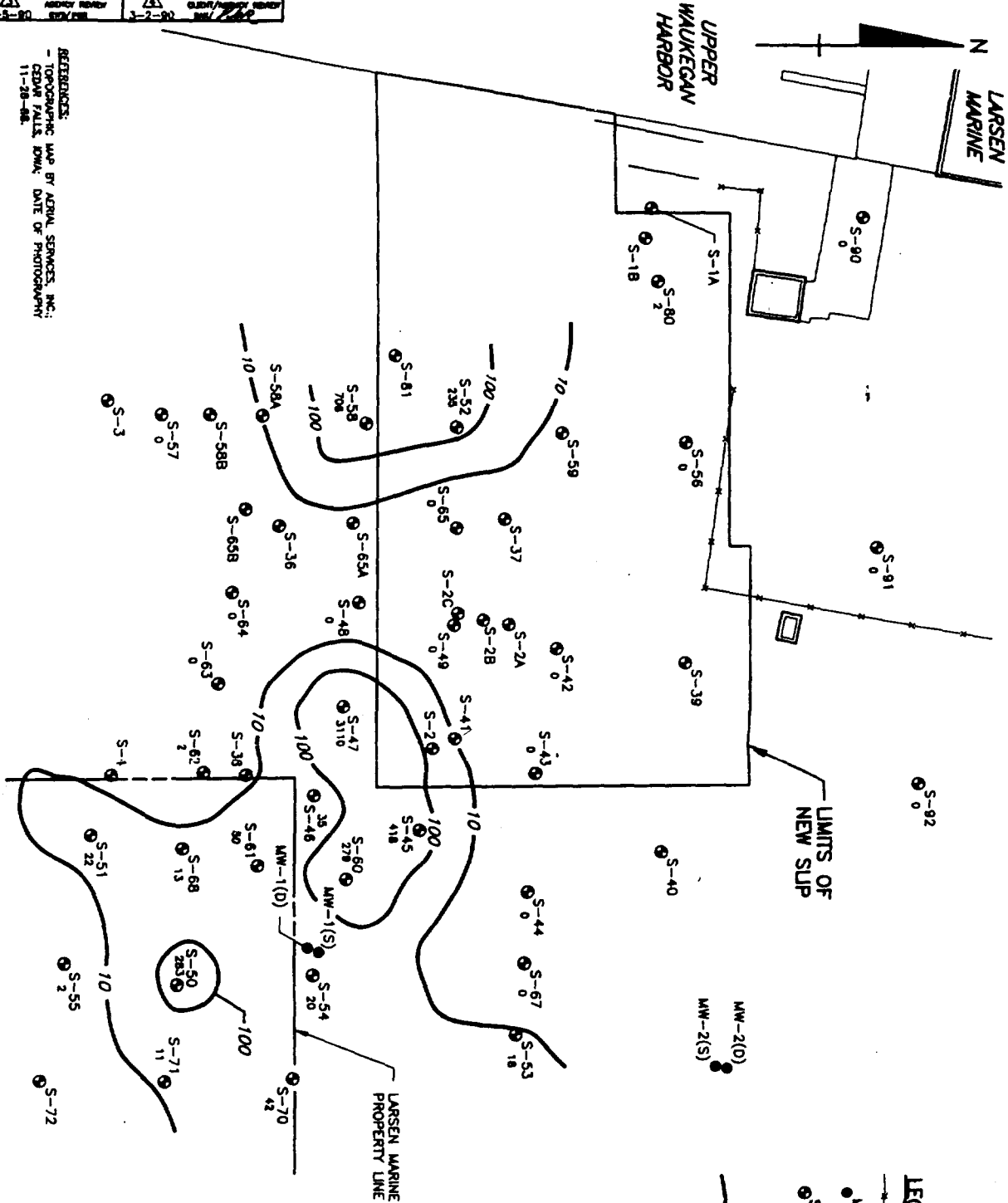
- CEDAR FALLS, IOWA DATE OF PHOTOGRAPHY

11-28-88.



REVISIONS	NO.	DATE	REASON FOR CHG. CLASS. REASON	REASON FOR CHG. CLASS. REASON	DRAWN BY	CHK	CHECKED BY	DRAWING NUMBER
		12-15-88		1-2-90		12-13-88	APPROVED BY	87-126-B154
		2-5-90						

REFERENCES:  
- TOPOGRAPHIC MAP BY AERIAL SERVICES, INC.;  
CEDAR FALLS, IOWA; DATE OF PHOTOGRAPHY  
11-28-66.



**LEGEND:**

**FENCE**

● MW-2(D)  
MONITORING WELL

SOIL BORING

— CARCINOGENIC PNAS (ppm)

—10—  
CARCINOGENIC PNAS CONCENTRATION  
CONTOUR (ppm)

**DRAFT**

A vertical scale bar with markings at 50, 0, and 50 FEET. The word "SCALE" is written vertically to the right of the bar.

CARCINOGENIC PNAS - 5' DEPTH  
CONCENTRATION CONTOURS  
NEW SLIP AREA  
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

WAUKEGAN HARBOR TRUST  
**Canon** Environmental

DATE: 12-13-00	FIGURE 3	DRAWING NUMBER 67-120-0154
SCALE: AS SHOWN		

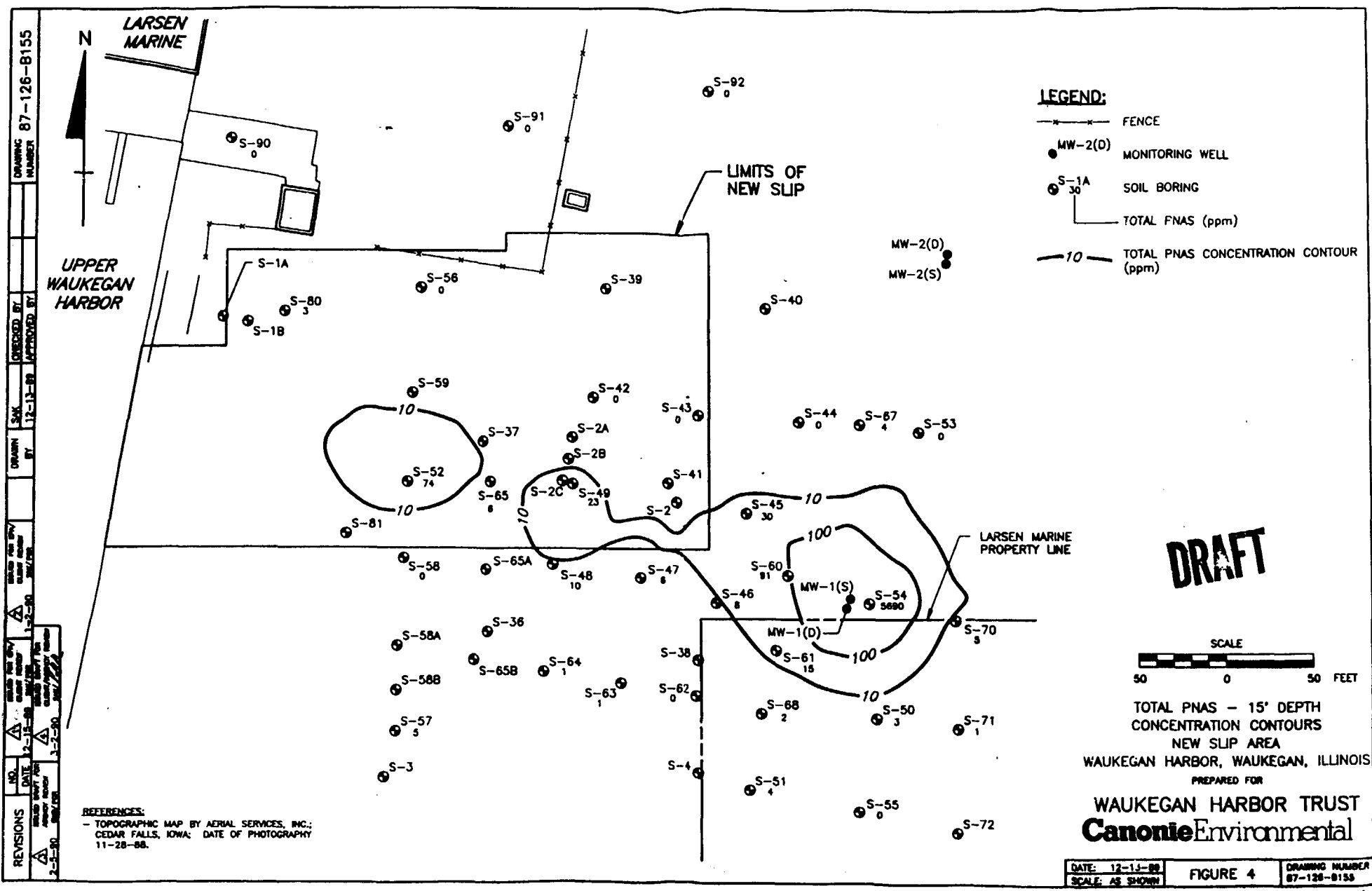






TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
Acenaphthene	840	1200	200	<.01	<.01
Acenaphthylene	260	440	65	<.01	<.01
Anthracene	<.10 <sup>b</sup>	<.10	120	<.01	<.01
Benzo(A)Anthracene	610	700	140	<.01	<.01
Benzo(A)Pyrene	<.10	<.10	760	<.01	<.01
Benzo(B)Fluoranthene	110	110	85	<.01	<.01
Benzo(G,H,I)Perylene	<.01	<.10	23	<.01	<.01
Benzo(K)Fluoranthene	<.10	<.10	74	<.01	<.01
Benzyl Butyl Phthalate	<.10	<.10	<0.33	<.01	<.01
Bis(2-Chloroethoxy)Methane	<.01	<.10	<3.3	<.01	<.01
Bis(2-Chloroethyl)Ether	<.01	<.10	<0.33	<.01	<.01
Bis(2-Chloroisopropyl)Ether	<.01	<.01	<0.33	<.01	<.01
Bis(2-Ethylhexyl)Phthalate	97	86	<0.33	<.01	<.01
Benzidine	<.10	<.10	NT <sup>c</sup>	<.01	<.01
4-Bromophenyl Phenyl Ether	5.5	32	NT	<.01	<.01
2 Chloronaphthalene	<.10	<.10	NT	<.01	<.01
4-Chlorophenyl Phenyl ether	280	430	<0.33	<.01	<.01
Chrysene	520	540	110	<.01	<.01
Dibenzo(A,H)Anthracene	<.10	<.10	5.7	<.01	<.01

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
1,2-Dichlorobenzene	<.01	<.10	<0.33	<.01	<.01
1,3-Dichlorobenzene	<.01	<.10	<0.33	<.01	<.01
1,4-Dichlorobenzene	34	<.10	<0.33	<.01	<.01
3,3'-Dichlorobenzidine	<.10	<.10	<0.66	<.01	<.01
Diethylphthalate	55	100	<0.33	<.01	<.01
Dimethylphthalate	95	120	<0.33	<.01	<.01
2,4-Dinitrotoluene	<.10	<.10	2.5	<.01	<.01
2,6-Dinitrotoluene	<.10	200	<0.33	<.01	<.01
Di-N-Butylphthalate	180	230	<0.33	<.01	<.01
Di-N-Octylphthalate	380	400	<0.33	<.01	<.01
1,2-Diphenylhydrazine	<.10	<.10	NT	<.01	<.01
Fluoranthene	1900	2200	390	<.01	<.01
Fluorene	1200	1700	290	<.01	<.01
Hexachlorobenzene	<.10	<.10	<0.33	<.01	<.01
Hexachlorobutadiene	<.10	<.10	<3.3	<.01	<.01
Hexachlorocyclopentadiene	5700	<.10	<0.33	<.01	<.01
Hexachloroethane	<.10	<.10	<0.33	<.01	<.01
Indeno(1,2,3,C,D)Pyrene	<.10	<.10	23	<.01	<.01

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
Isophorone	<.10	<.10	<3.3	<.01	<.01
Naphthalene	8200	12,000	>1000	<.01	<.01
Nitrobenzene	<.10	<.10	<3.3	<.01	<.01
N-Nitrosodiphenylamine	200	270	<0.33	<.01	<.01
N-Nitroso-Di-N-Propylamine	<.10	<.10	<0.33	<.01	<.01
N-Nitrosodimethylamine	<.01	<.01	NT	<.01	<.01
Phenanthrene	5300	6400	710	<.01	<.01
Pyrene	1500	1700	430	<.01	<.01
1,2,4-Trichlorobenzene	<.10	<.10	<3.3	<.01	<.01
2-Chlorophenol	NT	NT	<0.33	NT	NT
4-Chloro-3-Methylphenol	NT	NT	<3.3	NT	NT
2,4-Dichlorophenol	NT	NT	<3.3	NT	NT
2,4-Dimethylphenol	NT	NT	6.9	NT	NT
2,4-Dinitrophenol	NT	NT	<1.6	NT	NT
4,6-Dinitro-2-Methylphenol	NT	NT	<1.6	NT	NT
2-Nitrophenol	NT	NT	<3.3	NT	NT
4-Nitrophenol	NT	NT	<1.6	NT	NT
Pentachlorophenol	NT	NT	<1.6	NT	NT
Phenol	NT	NT	73	NT	NT

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
2,4,6-Trichlorophenol	NT	NT	<0.33	NT	NT
Aldrin	NT	NT	<0.33	NT	NT
BHC, Alpha-	NT	NT	<0.33	NT	NT
BHC, Beta-	NT	NT	8.8	NT	NT
BHC, Delta-	NT	NT	<0.33	NT	NT
BHC, Gamma- (Lindane)	NT	NT	49	NT	NT
4,4'-DDD (P,P'-)	NT	NT	<3.3	NT	NT
4,4'-DDE (P,P'-)	NT	NT	<0.33	NT	NT
4,4'-DDT (P,P'-)	NT	NT	<0.33	NT	NT
Dieldrin	NT	NT	<0.33	NT	NT
Endosulfan I	NT	NT	<0.33	NT	NT
Endosulfan II	NT	NT	<0.33	NT	NT
Endosulfan Sulfate	NT	NT	<0.33	NT	NT
Endrin	NT	NT	<0.33	NT	NT
Endrin Aldehyde	NT	NT	<0.33	NT	NT
Heptachlor	NT	NT	<0.33	NT	NT
Heptachlor Expoxide	NT	NT	<0.33	NT	NT
Toxaphene	NT	NT	<3.3	NT	NT
Benzyl Alcohol	NT	NT	<0.33	NT	NT

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
1,1,2-Trichloroethane	NT	NT	<0.001	NT	NT
Trichloroethylene	NT	NT	<0.001	NT	NT
Trichlorofluoromethane	NT	NT	<0.001	NT	NT
Vinyl Chloride	NT	NT	0.055	NT	NT
Barium - Total	NT	NT	2.5	NT	NT

Notes:

<sup>a</sup>Sample collection dates are: Boring S-41, March 16, 1989, Boring S-2, January 13, 1989, Borings S-36 and S-39, February 2, 1989.

<sup>b</sup><.10 - Not detected to level shown.

<sup>c</sup>NT - Not tested.

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
1,1-Dichloroethane	NT	NT	<0.001	NT	NT
1,2-Dichloroethane	NT	NT	<0.001	NT	NT
1,1-Dichloroethylene	NT	NT	<0.001	NT	NT
1,2-Dichloropropane	NT	NT	<0.001	NT	NT
Dichloropropylene (Mixed)	NT	NT	<0.001	NT	NT
Ethylbenzene	NT	NT	0.003	NT	NT
Methyl Bromide	NT	NT	<0.001	NT	NT
Methyl Chloride	NT	NT	<0.001	NT	NT
Methylene Chloride	NT	NT	<0.001	NT	NT
1,1,2,2-Tetrachloroethane	NT	NT	<0.001	NT	NT
Tetrachloroethylene	NT	NT	<0.001	NT	NT
Toluene	NT	NT	0.008	NT	NT
1,2-Transdichloroethylene	NT	NT	<0.001	NT	NT
1,1,1-Trichloroethane	NT	NT	<0.001	NT	NT

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
4-Chloroaniline	NT	NT	<3.3	NT	NT
Dibenzofuran	NT	NT	190	NT	NT
2-Methylnaphthalene	NT	NT	280	NT	NT
2-Nitroaniline	NT	NT	<0.33	NT	NT
3-Nitroaniline	NT	NT	<0.33	NT	NT
4-Nitroaniline	NT	NT	<0.33	NT	NT
2-Methylphenol (O-Cresol)	NT	NT	16	NT	NT
4-Methylphenol (P-Cresol)	NT	NT	61	NT	NT
2,4,5-Trichlorophenol	NT	NT	<0.33	NT	NT
Chlordane, Alpha	NT	NT	<3.3	NT	NT
Chlordane, Gamma	NT	NT	<3.3	NT	NT
Endrin Ketone	NT	NT	<0.33	NT	NT
Methoxychlor	NT	NT	51	NT	NT
Cadmium - Total	NT	NT	0.5	NT	NT
Chromium - Total	NT	NT	2.1	NT	NT

TABLE 1  
SUMMARY OF SOIL CHEMICAL DATA  
WAUKEGAN HARBOR SITE  
WAUKEGAN, ILLINOIS  
(Continued)

Compound (ppm)	Boring S-41 <sup>a</sup> 6.0 to 7.5 (ft.)	Boring S-41 23.5 to 25.0 (ft.)	Boring S-2 20.0 to 22.0 (ft.)	Boring S-36 8.0 to 9.5 (ft.)	Boring S-39 3.0 to 4.5 (ft.)
Lead - Total	NT	NT	2.9	NT	NT
Silver - Total	NT	NT	<0.2	NT	NT
Arsenic - Total	NT	NT	14	NT	NT
Selenium - Total	NT	NT	<0.50	NT	NT
Mercury - Total	NT	NT	<0.010	NT	NT
Benzene	NT	NT	0.002	NT	NT
Bromoform	NT	NT	<0.001	NT	NT
Carbon Tetrachloride	NT	NT	<0.001	NT	NT
Chlorobenzene	NT	NT	<0.001	NT	NT
Chlorodibromomethane	NT	NT	<0.001	NT	NT
Chloroethane	NT	NT	<0.001	NT	NT
2-Chloroethylvinyl Ether	NT	NT	<0.001	NT	NT
Chloroform	NT	NT	<0.001	NT	NT
Dichlorobromomethane	NT	NT	<0.001	NT	NT
Dichlorodifluoromethane	NT	NT	<0.001	NT	NT

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-42	S-42	S-42	S-42	S-43	S-43	S-43
Canonie I.D. #:	S-42-01	S-42-02	S-42-03	S-42-03	S-43-01	S-43-02	S-43-03
CompuChem I.D. #:	077567	077574	077575	D77575	077160	077173	077174
Sample Depth (feet):	5	15	24	24	5	15	25
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			59	79			64
2-Methylphenol			7.5				13
4-Methylphenol			37	31			72
2,4-Dimethylphenol			3.4				4.6
Naphthalene							
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene	1.3				1.9		
Dibenzofuran							
Fluorene							
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	0	106.9	110	0	0	153.6
Total non-carc. PNAs	1.3	0	0	0	1.9	0	0
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	1.3	0	0	0	1.9	0	0
Total Pesticides							
Typical Detection Level	0.35	0.37	3.2	8	0.39	0.4	7.7

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-43	S-44	S-44	S-44	S-44	S-45	S-45
Canonie I.D. #:	S-43-03	S-44-01	S-44-02	S-44-03	S-44-03	S-45-01	S-45-01
CompuChem I.D. #:	D77174	077576	077577	077578	D77578	078655	D78655
Sample Depth (feet):	25	5	15	23.5	23.5	5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	78			25	51		
2-Methylphenol				5.5			
4-Methylphenol	41			23	23		
2,4-Dimethylphenol				4.2			
Naphthalene						1500	2700
4-Chloroaniline							
2-Methylnaphthalene						390	260
Acenaphthylene							
Acenaphthene						500	380
Dibenzofuran						380	250
Fluorene						490	300
Phenanthrene						970	1000
Anthracene						260	
Fluoranthene						520	400
Pyrene						350	
Benzo(a)Anthracene (carc.)						130	
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)						120	
Benzo(b)Fluoranthene (carc.)						58	
Benzo(k)Fluoranthene (carc.)						51	
Benzo(a)Pyrene (carc.)						59	
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	119	0	0	57.7	74	0	0
Total non-carc. PNAs	0	0	0	0	0	5360	5290
Total carc. PNAs	0	0	0	0	0	418	0
Total PNAs	0	0	0	0	0	5778	5290
Total Pesticides							
Typical Detection Level	7.7	0.39	0.4	0.39	6.7	23	230

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-45	S-45	S-45	S-45	S-45	S-45	S-46
Canonie I.D. #:	S-45-02	S-45-02	DUP-03	DUP-03	S-45-03	S-45-03	S-46-01
CompuChem I.D. #:	078657	J78657	078664	D78664	078658	D78658	077982
Sample Depth (feet):	15	15	15	15	24	24	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			50	71	68	170	
2-Methylphenol			11	8.7	17	21	
4-Methylphenol			29	42	49	72	
2,4-Dimethylphenol			7.9		8.6		
Naphthalene	8.4	9.6	0.88				13
4-Chloroaniline							
2-Methylnaphthalene	3.1	2.3			5.5		
Acenaphthylene							
Acenaphthene	5	2.9					45
Dibenzofuran	3.9	2.6					30
Fluorene	1.2						40
Phenanthrene	1.2				3		88
Anthracene							12
Fluoranthene	0.67						56
Pyrene							30
Benzo(a)Anthracene (carc.)							10
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							9.2
Benzo(b)Fluoranthene (carc.)							4.2
Benzo(k)Fluoranthene (carc.)							6.1
Benzo(a)Pyrene (carc.)							5.2
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	0	97.9	121.7	142.6	263	0
Total non-carc. PNAs	23.47	17.4	0.88	0	8.5	0	314
Total carc. PNAs	0	0	0	0	0	0	34.7
Total PNAs	23.47	17.4	0.88	0	8.5	0	348.7
Total Pesticides							
Typical Detection Level	0.4	1.2	0.4	8	2.1	17	2

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-46	S-46	S-46	S-46	S-47	S-47	S-47
Canonie I.D. #:	S-46-01	S-46-02	S-46-03	S-46-03	S-47-01	S-47-01	S-47-02
CompuChem I.D. #:	D77982	D77983	D77984	D77984	D77985	D77985	D77986
Sample Depth (feet):	5	15	23.5	23.5	5	5	15
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			11	14			
2-Methylphenol			2.7	1.4			
4-Methylphenol			8.6	8.1			
2,4-Dimethylphenol			2.4	1.1			
Naphthalene		4			2700	5900	4.5
4-Chloroaniline							
2-Methylnaphthalene		0.99			1700	2300	
Acenaphthylene					340		
Acenaphthene	31	1.4			930	1100	
Dibenzofuran	19	0.59			810	960	
Fluorene	23				1300	1600	
Phenanthrene	82	0.89			2800	4800	0.69
Anthracene					650	880	
Fluoranthene	29				1700	2900	
Pyrene	27				1800	2200	
Benzo(a)Anthracene (carc.)					700	770	
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)					800	800	
Benzo(b)Fluoranthene (carc.)					340	770	
Benzo(k)Fluoranthene (carc.)					340	770	
Benzo(a)Pyrene (carc.)					370		
Indeno(1,2,3-c,d)Pyrene (carc.)					130		
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i,l)Perylene					120		
Beta-BHC							
Total Phenols	0	0	24.7	24.6	0	0	0
Total non-carc. PNAs	211	7.87	0	0	14850	22640	5.19
Total carc. PNAs	0	0	0	0	2680	3110	0
Total PNAs	211	7.87	0	0	17530	25750	5.19
Total Pesticides							
Typical Detection Level	9.8	0.39	0.37	1.1	110	440	0.4

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-47	S-47	S-47	S-48	S-48	S-48	S-48
Canonie I.D. #:	DUP-02	S-47-03	S-47-03	S-48-01	S-48-02	DUP-01	DUP-01
CompuChem I.D. #:	D77998	077987	D77987	077988	077989	077997	D77997
Sample Depth (feet):	15			5	15	15	15
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol		27	64		2.6	5.6	4.8
2-Methylphenol		7.9				0.8	
4-Methylphenol		16	25		0.93	2.8	2.3
2,4-Dimethylphenol		5.2					
Naphthalene	6.2	5			5.9	9.8	14
4-Chloroaniline							
2-Methylnaphthalene		1					
Acenaphthylene							
Acenaphthene				1.3			
Dibenzofuran				0.6			
Fluorene							
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	56.1	89	0	3.53	9.2	7.1
Total non-carc. PNAs	6.2	6	0	1.9	5.9	9.8	14
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	6.2	6	0	1.9	5.9	9.8	14
Total Pesticides							
Typical Detection Level	0.79	0.38	11	0.39	0.78	0.39	1.9

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-48	S-48	S-49	S-49	S-49	S-49	S-49
Canonie I.D. #:	S-48-03	S-48-03	S-49-01	S-49-02	S-49-02	S-49-03	S-49-03
CompuChem I.D. #:	077990	077990	077579	077580	077580	077582	077582
Sample Depth (feet):	23.5	23.5	5	15	15	23.5	23.5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	67	160		0.48		35	93
2-Methylphenol	16	17				6.3	
4-Methylphenol	45	67		0.43		24	28
2,4-Dimethylphenol	6.1					2.6	
Naphthalene	6		0.48	0.97	20	3.5	
4-Chloroaniline							
2-Methylnaphthalene				4.1	3.1		
Acenaphthylene							
Acenaphthene			1.3	2.8			
Dibenzofuran				0.67			
Fluorene							
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	134.1	244	0	0.91	0	67.9	121
Total non-carc. PNAs	6	0	1.78	8.54	23.1	3.5	0
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	6	0	1.78	8.54	23.1	3.5	0
Total Pesticides							
Typical Detection Level	0.39	16	0.38	0.38	1.9	0.39	7.8

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-50	S-50	S-50	S-50	S-50	S-51	S-51
Canonie I.D. #:	S-50-01	S-50-01	S-50-02	S-50-03	S-50-03	S-51-01	S-51-01
CompuChem I.D. #:	080167	D80167	080168	080316	D80316	0280317	J80317
Sample Depth (feet):	5	5	15	25	25	5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol				25	78		
2-Methylphenol				9.9			
4-Methylphenol				40	28		
2,4-Dimethylphenol				4.3			
Naphthalene			2.6				0.81
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene	37						5.8
Dibenzofuran	28						0.88
Fluorene	210	140					2.1
Phenanthrene			0.53	0.42			2.3
Anthracene	25						0.76
Fluoranthene	560	590					14
Pyrene	470	480					8.9
Benzo(a)Anthracene (carc.)	99	76					4.2
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)	93	71					7.2
Benzo(b)Fluoranthene (carc.)	33						3.7
Benzo(k)Fluoranthene (carc.)	24						2.2
Benzo(a)Pyrene (carc.)	34						2.6
Indeno(1,2,3-c,d)Pyrene (carc.)							1.3
Dibenzo(a,h)Anthracene (carc.)							0.57
Benzo(g,h,i)Perylene							1.3
Beta-BHC						0.15	
Total Phenols	0	0	0	79.2	106		0
Total non-carc. PNAs	1330	1210	3.13	0.42	0		36.85
Total carc. PNAs	283	147	0	0	0		21.77
Total PNAs	1613	1357	3.13	0.42	0		58.62
Total Pesticides						0.15	
Typical Detection Level	24	71	0.39	0.41	8.1	0.02	0.39

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-51	S-51	S-51	S-51	S-52	S-52	S-52
Canonie I.D. #:	S-51-01	S-51-02	S-51-03	S-51-03	S-52-01	S-52-01	S-52-02
CompuChem I.D. #:	D80317	080318	080319	D80319	080320	D80320	080321
Sample Depth (feet):	5	15	25	25	5	5	15
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			36	130			16
2-Methylphenol			17	16			2.3
4-Methylphenol			64	71			7.5
2,4-Dimethylphenol			8.7				
Naphthalene		3.9			2.8		27
4-Chloroaniline							
2-Methylnaphthalene					2.2		
Acenaphthylene					9.4		
Acenaphthene	4.3				67	140	
Dibenzofuran					57	100	
Fluorene					67	130	
Phenanthrene					170	480	
Anthracene					34	130	
Fluoranthene	11				110	230	
Pyrene	8.9				79	180	
Benzo(a)Anthracene (carc.)	2.8				50	55	
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)	5.5				43	61	
Benzo(b)Fluoranthene (carc.)					50		
Benzo(k)Fluoranthene (carc.)					50		
Benzo(a)Pyrene (carc.)					30		
Indeno(1,2,3-c,d)Pyrene (carc.)					7.6		
Dibenzo(a,h)Anthracene (carc.)					4.1		
Benzo(g,h,i)Perylene					6.8		
Beta-BHC							
Total Phenols	0	0	125.7	217	0	0	25.8
Total non-carc. PNAs	24.2	3.9	0	0	605.2	1390	27
Total carc. PNAs	8.3	0	0	0	234.7	116	0
Total PNAs	32.5	3.9	0	0	839.9	1506	27
Total Pesticides							
Typical Detection Level	2	0.39	0.4	8	0.78	47	1.6

TABLE 2: SOIL INVESTIGATION DATA, NEW SUP AREA

Boring No.:	S-52	S-52	S-52	S-52	S-52	S-53	S-53
Canonie I.D. #:	S-52-02	DUP-07	DUP-07	S-52-03	S-52-03	S-53-01	S-53-01
CompuChem I.D. #:	D80321	080325	J80325	080322	J80322	079348	D79348
Sample Depth (feet):	15	15	15	24	24	5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	8.6	5.5		23	57		
2-Methylphenol		1.8		7.1	5.5		
4-Methylphenol	4	4.4		33	31		
2,4-Dimethylphenol		0.82		3.1			
Naphthalene	22	15	74			0.45	
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene						0.46	
Dibenzofuran						0.46	
Fluorene						0.73	
Phenanthrene		1				2	2.2
Anthracene						0.86	0.8
Fluoranthene						8.5	8
Pyrene						7.8	5.3
Benzo(a)Anthracene (carc.)						3.2	2.6
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)						3.7	3.6
Benzo(b)Fluoranthene (carc.)						2.4	4.1
Benzo(k)Fluoranthene (carc.)						1.7	4.1
Benzo(a)Pyrene (carc.)						2.1	2.3
Indeno(1,2,3-c,d)Pyrene (carc.)						0.96	1.2
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene						1	1.4
Beta-BHC							
Total Phenols	12.6	12.52	0	66.2	93.5	0	0
Total non-carc. PNAs	22	16	74	0	0	22.26	17.7
Total carc. PNAs	0	0	0	0	0	14.06	17.9
Total PNAs	22	16	74	0	0	36.32	35.6
Total Pesticides							
Typical Detection Level	4	0.41	6.1	0.38	3.8	0.39	0.78

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-53	S-53	S-54	S-54	S-54	S-54	S-54
Canonie I.D. #:	S-53-02	S-53-03	S-54-01	S-54-01	S-54-02	S-54-03	S-54-03
CompuChem I.D. #:	079350	079351	078629	D78629	J78632	078634	D78634
Sample Depth (feet):	15	24	5	5	15	24	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol		8.3				33	120
2-Methylphenol		2.2				9.7	
4-Methylphenol		6.2				27	43
2,4-Dimethylphenol		1.8				5.7	
Naphthalene			11	26	1200	1.5	
4-Chloroaniline							
2-Methylnaphthalene			0.5	7.9	510		
Acenaphthylene			0.98				
Acenaphthene			14	22	460	0.8	
Dibenzofuran			12	17	360	0.56	
Fluorene			17	27	460	0.65	
Phenanthrene			31	59	1400	2.1	
Anthracene			4.1	6.9	210		
Fluoranthene			16	28	680	0.82	
Pyrene			11	21	420	0.54	
Benzo(a)Anthracene (carc.)			5.1	4.3			
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)			4.8	5.2			
Benzo(b)Fluoranthene (carc.)			3.4				
Benzo(k)Fluoranthene (carc.)			2.7				
Benzo(a)Pyrene (carc.)			2.7				
Indeno(1,2,3-c,d)Pyrene (carc.)			1.2				
Dibenzo(a,h)Anthracene (carc.)			0.42				
Benzo(g,h,i,l)Perylene			0.87				
Beta-BHC							
Total Phenols	0	18.5	0	0	0	75.4	163
Total non-carc. PNAs	0	0	118.45	214.8	5700	6.97	0
Total carc. PNAs	0	0	20.32	9.5	0	0	0
Total PNAs	0	0	138.77	224.3	5700	6.97	0
Total Pesticides							
Typical Detection Level	0.39	0.8	0.4	4	120	0.4	16

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-55	S-55	S-55	S-55	S-56	S-56	S-56
Canonie I.D. #:	S-55-01	S-55-02	S-55-03	S-55-03	S-56-01	S-56-02	S-56-03
CompuChem I.D. #:	080164	080165	080166	080166	080557	080559	080558
Sample Depth (feet):	5	15	25	25	5	15	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			61	99		0.54	81
2-Methylphenol			12	11		0.61	11
4-Methylphenol			41	39		0.95	48
2,4-Dimethylphenol			5.1			0.45	6
Naphthalene							
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene							
Dibenzofuran							
Fluorene							
Phenanthrene	0.47						
Anthracene							
Fluoranthene	2.7						
Pyrene	1.9						
Benzo(a)Anthracene (carc.)	0.5						
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)	0.62						
Benzo(b)Fluoranthene (carc.)	0.45						
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	0	119.1	149	0	2.55	146
Total non-carc. PNAs	5.07	0	0	0	0	0	0
Total carc. PNAs	1.57	0	0	0	0	0	0
Total PNAs	6.64	0	0	0	0	0	0
Total Pesticides							
Typical Detection Level	0.39	0.39	0.4	8	0.4	0.4	0.4

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-56	S-57	S-57	S-57	S-57	S-58	S-58
Canonie I.D. #:	S-56-03	S-57-01	S-57-02	S-57-03	S-57-03	S-58-01	S-58-01
CompuChem I.D. #:	D80558	080771	080774	080784	080784	080787	D80787
Sample Depth (feet):	24	5	15	24	24	5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	61			14	26		
2-Methylphenol				3.1	34		
4-Methylphenol	34			31			
2,4-Dimethylphenol				3.7			
Naphthalene			4.4	1.7		4000	7600
4-Chloroaniline							2300
2-Methylnaphthalene			0.88			1800	
Acenaphthylene						27	
Acenaphthene		0.91				670	1000
Dibenzofuran		0.79				760	880
Fluorene		1.1				760	1100
Phenanthrene		2.8				1400	2900
Anthracene						600	700
Fluoranthene		0.46				680	680
Pyrene						840	
Benzo(a)Anthracene (carc.)						220	
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)						210	
Benzo(b)Fluoranthene (carc.)						73	
Benzo(k)Fluoranthene (carc.)						71	
Benzo(a)Pyrene (carc.)						97	
Indeno(1,2,3-c,d)Pyrene (carc.)						35	
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene						40	
Beta-BHC							
Total Phenols	95	0	0	51.8	60	0	0
Total non-carc. PNAs	0	6.06	5.28	1.7	0	11577	17160
Total carc. PNAs	0	0	0	0	0	706	0
Total PNAs	0	6.06	5.28	1.7	0	12283	17160
Total Pesticides							
Typical Detection Level	12	0.38	0.4	0.39	3.9	23	580

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-58	S-58	S-58	S-58	S-59	S-59	S-60
Canonie I.D. #:	DUP-09	DUP-09	S-58-02	S-58-03	S-59-03	S-59-03	S-60-01
CompuChem I.D. #:	080792	D80792	080788	080789	079546	D79546	078660
Sample Depth (feet):	5	5	15	24	24	24	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol				7.5	48	91	
2-Methylphenol					7.9		
4-Methylphenol				15	31	40	
2,4-Dimethylphenol				2	3.2		
Naphthalene	910	2100	29		5		6.1
4-Chloroaniline							
2-Methylnaphthalene	480	610			0.71		0.69
Acenaphthylene							4.8
Acenaphthene	220	250					37
Dibenzofuran	260						28
Fluorene	320	270					65
Phenanthrene	470	840			0.58		99
Anthracene	460	530					29
Fluoranthene	270						6.3
Pyrene	240						59
Benzo(a)Anthracene (carc.)	45						84
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)	47						45
Benzo(b)Fluoranthene (carc.)							55
Benzo(k)Fluoranthene (carc.)							55
Benzo(a)Pyrene (carc.)							27
Indeno(1,2,3-c,d)Pyrene (carc.)							8.8
Dibenzo(a,h)Anthracene (carc.)							4
Benzo(g,h,i)Perylene							6.5
Beta-BHC							
Total Phenols	0	0	0	24.5	90.1	131	0
Total non-carc. PNAs	3630	4600	29	0	6.29	0	341.39
Total carc. PNAs	92	0	0	0	0	0	278.8
Total PNAs	3722	4600	29	0	6.29	0	620.19
Total Pesticides							
Typical Detection Level	24	240	24	1.1	0.4	8	0.39

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-60	S-60	S-60	S-60	S-61	S-61	S-61
Canonie I.D. #:	S-60-01	S-60-02	S-60-03	S-60-03	S-61-01	S-61-01	S-61-02
CompuChem I.D. #:	D78660	078661	078662	D78662	078811	D78811	078812
Sample Depth (feet):	5	15	24	24	5	5	15
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			47	46			
2-Methylphenol			6.5	4.9			
4-Methylphenol			22	16			
2,4-Dimethylphenol			2.4				
Naphthalene		26	2.6		11	26	5.9
4-Chloroaniline							
2-Methylnaphthalene		8.3			1.6		2.1
Acenaphthylene					1.2		
Acenaphthene	56	8.5			9.7	11	2
Dibenzofuran	47	6.2			8	8	1.7
Fluorene	140	7.5			9.9	9.8	2.2
Phenanthrene	540	20			21	38	0.43
Anthracene	87				7.2	8.6	
Fluoranthene	320	8.8			17	38	
Pyrene	190	6.3			8.5	18	
Benzo(a)Anthracene (carc.)	40				7.8	6.3	
Bis(2-Ethylhexyl)Phthalate							0.6
Chrysene (carc.)	47				8.4	9.5	
Benzo(b)Fluoranthene (carc.)					13	8.9	
Benzo(k)Fluoranthene (carc.)					13	8.9	
Benzo(a)Pyrene (carc.)					5.2		
Indeno(1,2,3-c,d)Pyrene (carc.)					2.1		
Dibenzo(a,h)Anthracene (carc.)					0.9		
Benzo(g,h,i)Perylene					1.7		
Beta-BHC							
Total Phenols	0	0	77.9	66.9	0	0	0
Total non-carc. PNAs	1380	91.6	2.6	0	96.8	157.4	14.93
Total carc. PNAs	87	0	0	0	50.4	33.6	0
Total PNAs	1467	91.6	2.6	0	147.2	191	14.93
Total Pesticides							
Typical Detection Level	39	2	2	4	0.39	3.1	0.4

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-61	S-61	S-62	S-62	S-62	S-62	S-62
Canonie I.D. #:	S-61-03	S-61-03	S-62-01	S-62-02	DUP-04	S-62-03	S-62-03
CompuChem I.D. #:	078813	D78813	079352	079353	079364	079359	D79359
Sample Depth (feet):	24	24	5	15	15	24	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	68	100				33	63
2-Methylphenol	16					6.1	5
4-Methylphenol	39	38				19	25
2,4-Dimethylphenol	6.2					2.7	
Naphthalene	9.7	9.6	0.91		0.44		
4-Chloroaniline							
2-Methylnaphthalene	3.3						
Acenaphthylene	0.54						
Acenaphthene	3.3		2.4				
Dibenzofuran	2.5		1.7				
Fluorene	3.4		2				
Phenanthrene	9		2.4				
Anthracene	0.82						
Fluoranthene	4.4		2.7				
Pyrene	2.5		1.5				
Benzo(a)Anthracene (carc.)	0.96		0.58				
Bis(2-Ethylhexyl)Phthalate	0.43						
Chrysene (carc.)	0.8		0.64				
Benzo(b)Fluoranthene (carc.)	0.71		0.59				
Benzo(k)Fluoranthene (carc.)	0.69		0.59				
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	129.2	138	0	0	0	60.8	93
Total non-carc. PNAs	39.89	9.6	13.61	0	0.44	0	0
Total carc. PNAs	3.15	0	2.4	0	0	0	0
Total PNAs	43.04	9.6	16.01	0	0.44	0	0
Total Pesticides							
Typical Detection Level	0.4	8.1	0.39	0.41	0.4	0.39	3.9

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-63	S-63	S-63	S-63	S-64	S-64	S-64
Canonie I.D. #:	S-63-01	S-63-02	S-63-03	S-63-03	S-64-01	S-64-02	S-64-03
CompuChem I.D. #:	079361	079362	079363	079363	079548	079549	079550
Sample Depth (feet):	5	15	24	24	5	15	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol			38	80			43
2-Methylphenol			7.1	6.3			8.2
4-Methylphenol			22	33			28
2,4-Dimethylphenol			3.7				3.8
Naphthalene		0.52				1.3	
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene	5.8				2.4		
Dibenzofuran	4.4				0.41		
Fluorene	4.5						
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	0	68.8	119.3	0	0	83
Total non-carc. PNAs	14.7	0.52	0	0	2.81	1.3	0
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	14.7	0.52	0	0	2.81	1.3	0
Total Pesticides							
Typical Detection Level	0.4	0.4	0.41	6.1	0.4	0.4	0.4

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-64	S-65	S-65	S-65	S-65	S-67	S-67
Canonie I.D. #:	S-64-03	S-65-01	S-65-02	S-65-03	S-65-03	S-67-01	S-67-02
CompuChem I.D. #:	D79550	080760	080790	080791	080791	079771	079778
Sample Depth (feet):	24	5	15	24	24	5	16
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	93		1.4	93	39		
2-Methylphenol				16			
4-Methylphenol	40		0.61	43	16		
2,4-Dimethylphenol				5.3			
Naphthalene			5.6	15			
4-Chloroaniline							
2-Methylnaphthalene			0.57				
Acenaphthylene							
Acenaphthene							
Dibenzofuran		0.45					
Fluorene		1.3					
Phenanthrene		1.3					1.7
Anthracene		0.79					
Fluoranthene		1					1.5
Pyrene		0.66					0.91
Benzo(a)Anthracene (carc.)							0.42
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	133	0	2.01	157.3	55	0	0
Total non-carc. PNAs	0	5.5	6.17	15	0	0	4.11
Total carc. PNAs	0	0	0	0	0	0	0.42
Total PNAs	0	5.5	6.17	15	0	0	4.53
Total Pesticides							
Typical Detection Level	8	0.39	0.4	2	12	0.39	0.39

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-67	S-67	S-68	S-68	S-68	S-68	S-68
Canonie I.D. #:	S-67-03	S-67-03	S-68-01	S-68-02	S-68-03	S-68-03	DUP-06
CompuChem I.D. #:	079783	D79783	079748	079753	079755	D79755	079784
Sample Depth (feet):	25	25	5	15	24	24	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	76	58			120	110	79
2-Methylphenol	11				19		21
4-Methylphenol	51	28			73	43	54
2,4-Dimethylphenol	6.8				6.7		14
Naphthalene				1.7			0.9
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene			7.5				
Dibenzofuran			5.3				
Fluorene			4.6				
Phenanthrene	0.51		4.4	0.68			0.72
Anthracene							
Fluoranthene	0.44		16				
Pyrene			8.6				
Benzo(a)Anthracene (carc.)			2.6				
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)			3.7				
Benzo(b)Fluoranthene (carc.)			3.4				
Benzo(k)Fluoranthene (carc.)			3.4				
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	144.8	86	0	0	218.7	153	168
Total non-carc. PNAs	0.96	0	48.4	2.38	0	0	1.62
Total carc. PNAs	0	0	13.1	0	0	0	0
Total PNAs	0.96	0	59.5	2.38	0	0	1.62
Total Pesticides							
Typical Detection Level	0.41	8.1	1.9	0.4	0.4	16	0.42

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-68	S-70	S-70	S-70	S-70	S-70	S-70
Canonie I.D. #:	DUP-06	S-70-01	S-70-01	S-70-02	DUP-05	S-70-03	S-70-03
CompuChem I.D. #:	J79784	J79551	079551	079552	079554	079553	079553
Sample Depth (feet):	24	5	5	15	15	24	24
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	210					30	55
2-Methylphenol						6.4	
4-Methylphenol	79					20	20
2,4-Dimethylphenol						3.1	
Naphthalene				5.4	4.7		
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene		0.81					
Acenaphthene							
Dibenzofuran							
Fluorene							
Phenanthrene		1.7					
Anthracene		1.5					
Fluoranthene		24	51				
Pyrene		22	27				
Benzo(a)Anthracene (carc.)		5	9.2				
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)		5.7	11				
Benzo(b)Fluoranthene (carc.)		5.8	5.8				
Benzo(k)Fluoranthene (carc.)		7.5	11				
Benzo(a)Pyrene (carc.)		5	5.8				
Indeno(1,2,3-c,d)Pyrene (carc.)		1.9					
Dibenzo(a,h)Anthracene (carc.)		1.1					
Benzo(g,h,i,l)Perylene		1.7					
Beta-BHC							
Total Phenols	289	0	0	0	0	59.5	75
Total non-carc. PNAs	0	51.71	78	5.4	4.7	0	0
Total carc. PNAs	0	32	42.4	0	0	0	0
Total PNAs	0	83.71	120.4	5.4	4.7	0	0
Total Pesticides							
Typical Detection Level	21	0.79	3.9	0.41	0.4	0.4	8

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-71	S-71	S-71	S-71	S-71	S-80	S-80
Canonie I.D. #:	S-71-01	S-71-01	S-71-02	S-71-03	S-71-03	S-80-01	S-80-01
CompuChem I.D. #:	080566	080566	080567	080568	080568	080312	080312
Sample Depth (feet):	5	5	15	25.5	25.5	5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol				82	82		
2-Methylphenol				10			
4-Methylphenol				45	35		
2,4-Dimethylphenol				5.6			
Naphthalene			1			3.4	4
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene	0.41						
Acenaphthene	2.6	1.9				7.5	20
Dibenzofuran	2.9	2.4				0.72	
Fluorene	0.47	3.6				0.81	
Phenanthrene	1.1						
Anthracene	0.77						
Fluoranthene	8.1	5.9					
Pyrene	6.6	5.7				0.42	
Benzo(a)Anthracene (carc.)	0.79						
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)	1.4	1.1					
Benzo(b)Fluoranthene (carc.)	3.2	2.6					
Benzo(k)Fluoranthene (carc.)	3.2	2.6					
Benzo(a)Pyrene (carc.)	1.8	1.5					
Indeno(1,2,3-c,d)Pyrene (carc.)	0.83						
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene	0.79						
Beta-BHC							
Total Phenols	0	0	0	142.6	117	0	0
Total non-carc. PNAs	23.74	19.5	1	0	0	12.85	24
Total carc. PNAs	11.22	7.8	0	0	0	0	0
Total PNAs	34.96	27.3	1	0	0	12.85	24
Total Pesticides							
Typical Detection Level	0.4	0.8	0.4	0.4	12	0.42	2.1

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-80	S-80	S-80	S-80	S-90	S-90	S-90
Canonie I.D. #:	S-80-02	DUP-08	DUP-08	S-80-03	S-90-01	S-90-02	S-90-02
CompuChem I.D. #:	080313	080315	D80315	080314	0289150	0289151	D289151
Sample Depth (feet):	15	15	15	24	5	15	15
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol	28	16	31	2.8		4	4.1
2-Methylphenol	2.2	3.2	3.5			2.5	2.3
4-Methylphenol	14	12	16	5.5		20	24
2,4-Dimethylphenol		1.9		2.6		5.3	4.7
Naphthalene		2	2.6	3.3			
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene							
Dibenzofuran							
Fluorene							
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i,l)Perylene							
Beta-BHC							
Total Phenols	44.2	33.1	50.5	10.9	0	31.8	35.1
Total non-carc. PNAs	0	2	2.6	3.3	0	0	0
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	0	2	2.6	3.3	0	0	0
Total Pesticides							
Typical Detection Level	2	0.4	2	0.8	0.38	0.38	1.9

TABLE 2: SOIL INVESTIGATION DATA, NEW SLIP AREA

Boring No.:	S-90	S-90	S-90	S-91	S-91	S-91	S-92
Canonie I.D. #:	DUP-10	S-90-03	S-90-03	S-91-01	S-91-02	S-91-03	S-92-01
CompuChem I.D. #:	0289156	0289152	D289152	289153	289154	289155	288143
Sample Depth (feet):	15	24	24	5	15	25.5	5
Concentration	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Chemical Name							
Phenol		33	41			62	
2-Methylphenol		7.8	6.9		0.48	6.4	
4-Methylphenol		34	41		4.1	34	
2,4-Dimethylphenol		6.9	5.8		2.2		
Naphthalene							
4-Chloroaniline							
2-Methylnaphthalene							
Acenaphthylene							
Acenaphthene							
Dibenzofuran							
Fluorene							
Phenanthrene							
Anthracene							
Fluoranthene							
Pyrene							
Benzo(a)Anthracene (carc.)							
Bis(2-Ethylhexyl)Phthalate							
Chrysene (carc.)							
Benzo(b)Fluoranthene (carc.)							
Benzo(k)Fluoranthene (carc.)							
Benzo(a)Pyrene (carc.)							
Indeno(1,2,3-c,d)Pyrene (carc.)							
Dibenzo(a,h)Anthracene (carc.)							
Benzo(g,h,i)Perylene							
Beta-BHC							
Total Phenols	0	81.7	94.7	0	6.78	102.4	0
Total non-carc. PNAs	0	0	0	0	0	0	0
Total carc. PNAs	0	0	0	0	0	0	0
Total PNAs	0	0	0	0	0	0	0
Total Pesticides							
Typical Detection Level	0.39	0.39	3.9	0.38	0.4	5.5	0.39

TABLE 2: SOIL INVESTIGATION DATA, NEW SUP AREA

Boring No.:	S-92	S-92	S-92
Canonie I.D. #:	S-92-02	S-92-03	S-92-03
CompuChem I.D. #:	288136	288144	D288144
Sample Depth (feet):	15	26.5	26.5
Concentration	(ppm)	(ppm)	(ppm)
Chemical Name			
Phenol	0.84	13	16
2-Methylphenol	1.6	2.4	2.5
4-Methylphenol	3.4	16	18
2,4-Dimethylphenol	1	3.5	3.3
Naphthalene			
4-Chloroaniline			
2-Methylnaphthalene			
Acenaphthylene			
Acenaphthene			
Dibenzofuran			
Fluorene			
Phenanthrene			
Anthracene			
Fluoranthene			
Pyrene			
Benzo(a)Anthracene (carc.)			
Bis(2-Ethylhexyl)Phthalate			
Chrysene (carc.)			
Benzo(b)Fluoranthene (carc.)			
Benzo(k)Fluoranthene (carc.)			
Benzo(a)Pyrene (carc.)			
Indeno(1,2,3-c,d)Pyrene (carc.)			
Dibenzo(a,h)Anthracene (carc.)			
Benzo(g,h,i,l)Perylene			
Beta-BHC			
Total Phenols	6.84	34.9	39.8
Total non-carc. PNAs	0	0	0
Total carc. PNAs	0	0	0
Total PNAs	0	0	0
Total Pesticides			
Typical Detection Level	0.39	0.37	1.5

B&V WASTE SCIENCE AND TECHNOLOGY CORP.

TEL (312) 346-3775

1590

ENVIRONMENTAL

230 WEST MONROE, SUITE 2250  
CHICAGO, ILLINOIS 60606  
FAX: (312) 346-4781

March 7, 1990

Mr. Peter G. Romzick  
Project Engineer  
Canonie Environmental  
800 Canonie Drive  
Porter, Indiana 46304

Re: Outboard Marine Corporation  
Waukegan Harbor Facility Field Data  
Summary

Dear Pete:

As we discussed during our telephone conversation, enclosed are tables summarizing the analytical data of co-located subsurface soils samples collected during last summer's predesign field investigation activities. I have also enclosed a table which cross-references your station number with the CRL log number, organic traffic report numbers, and inorganic traffic report number.

If you have any questions or if I can be of any further service, please do not hesitate to contact me at (312) 346-3775.

Sincerely,

B&V WASTE SCIENCE AND TECHNOLOGY, CORP.



Louis M. Vasseur  
Project Manager

cc: C. Nolan, USEPA

ltr7/OMC#3

OUTBOARD MARINE CORP.  
PREDESIGN FIELD INVESTIGATION

FIELD DATA SUMMARY

<u>CRL LOG NO.</u>	<u>ORGANIC TRAFFIC REPORT NUMBER</u>	<u>INORGANIC TRAFFIC REPORT NUMBER</u>	<u>STATION NO.</u>
89 ZB10 S01	ECX 01	MECL 00	SS 44-02
89 ZB10 S02	ECX 02	-	SS 44-03
89 ZB10 S03	ECX 03	MECL 01	22 49-03
89 ZB10 R01	ECX 04	-	Rinsate
89 ZB10 S04	ECX 05	MECL 02	SS 48-03
89 ZB10 S05	ECX 06	MECL 03	SS 46-03
89 ZB10 D05	ECX 07	MECL 04	SS 46-03
89 ZB10 S06	ECX 08	MECL 05	SS 60-02
89 ZB10 S07	ECX 09	MECL 06	SS-70-03
89 ZB10 S08	ECX 10	MECL 07	SS-64-02 MS/MSD
89 ZB10 D09	ECX 11	MECL 08	SS-59

TABLE S-1  
SEMIVOLATILE ORGANIC ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL  
(page 2 of 2)

SEMIVOLATILE COMPOUND	SAMPLE LOCATION AND NUMBER													
	CONCENTRATIONS IN ug/kg													
	SS 44-02 ECX 01	SS 44-03 ECX 02	SS 44-03 ECX 02RE	SS 49-03 ECX 03	SS 49-03 ECX 03RE	RINSATE *ECX 04	SS 48-03 ECX 05	SS 48-03 ECX 05RE	SS 48-03 ECX 06	SS 48-03 ECX 06RE	SS 48-03 ECX 07	SS 48-03 ECX 07RE	SS 60-02 ECX 08	
Phenol	800 U	110000 E	110900	110000 E	110000	10 U	47000 E	59000	45000 E	54000	170000 E	220000	800 U	
bis(2-Chloroethyl)Ether	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2-Chlorophenol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	300 U	14000 U	800 U	
1,3-Dichlorobenzene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
1,4-Dichlorobenzene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Benzyl Alcohol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
1,2-Dichlorobenzene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2-Methylphenol	800 U	18000 E	13000	12000	10000	10 U	8200	8300	5100	5600	20000 E	24000	800 U	
bis(2-Chloroisopropyl)Ether	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
4-Methylphenol	800 U	81000 E	52000	45000 E	38000	10 U	29000 E	40000	18000 E	20000	63000 E	88000	800 U	
N-Nitroso-Dipropylamine	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Hexachloroethane	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Nitrobenzene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Isophorene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2-Nitrophenol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2,4-Dimethylphenol	800 U	8400	9400 U	2800	9700 U	10 U	5200	4100 U	1700	4000 U	800 U	14000 U	800 U	
Benzoic Acid	4000 U	3900 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	8300	72000 U	4000 U	
bis(2-Chloroethoxy)Methane	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	4000 U	14000 U	800 U	
2,4-Dichlorophenol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
1,2,4-Trichlorobenzene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Naphthalene	800 U	790 U	9400 U	7300	9700 U	10 U	2000	4100 U	800 U	4000 U	800 U	14000 U	12000	
4-Chloroaniline	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Hexachlorobutadiene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
4-Chloro-3-Methylphenol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2-Methylnaphthalene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	2900	
Hexachlorocyclopentadiene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2,4,6-Trichlorophenol	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2,4,5-Trichlorophenol	4000 U	3900 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
2-Chloronaphthalene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2-Nitroaniline	4000 U	3900 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
Dimethylphthalate	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Acenaphthylene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
2,6-Dinitrotoluene	800 U	790 U	9400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
3-Nitroaniline	4000 U	3900 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	

NOTE: RE equals Reanalysis  
\* indicates WATER

TABLE 5-2  
SEMIVOLATILE ORGANIC ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL  
(page 1 of 2)

SEMIVOLATILE COMPOUND	SAMPLE LOCATION AND NUMBER												
	CONCENTRATIONS IN ug/kg												
	SS 70 ECX 09	SS 70 ECX 09RE	SS 84 ECX 10	SS 84 ECX 10RE	SS 59 ECX 11	SS 59 ECX 11RE							
Acenaphthene	840 U	840 U	780 U	780 U	410 U	1800 U							
2,4-Dinitrophenol	4200 U	4200 U	3800 U	3800 U	2000 U	8100 U							
4-Nitrophenol	4200 U	4200 U	3800 U	3800 U	2000 U	8100 U							
Dibenzofuran	840 U	840 U	780 U	780 U	410 U	1800 U							
2,4-Dinitrotoluene	840 U	840 U	780 U	780 U	410 U	1800 U							
Diethylphthalate	840 U	840 U	780 U	780 U	410 U	1800 U							
4-Chlorophenyl Phenyl Ether	840 U	840 U	780 U	780 U	410 U	1800 U							
Fluorene	840 U	840 U	780 U	780 U	410 U	1800 U							
4-Nitroaniline	4200 U	4200 U	3800 U	3800 U	2000 U	8100 U							
4,6-Dinitro-2-Methylphenol	4200 U	4200 U	3800 U	3800 U	2000 U	8100 U							
N-Nitrosodiphenylamine(1)	840 U	840 U	780 U	780 U	410 U	1800 U							
4-Bromophenyl Phenyl Ether	840 U	840 U	780 U	780 U	410 U	1800 U							
Hexachlorobenzene	840 U	840 U	780 U	780 U	410 U	1800 U							
Pentachlorophenol	4200 U	4200 U	3800 U	3800 U	2000 U	8100 U							
Phenanthrene	840 U	840 U	780 U	780 U	410 U	1800 U							
Anthracene	840 U	840 U	780 U	780 U	410 U	1800 U							
Di-n-Butylphthalate	840 U	840 U	780 U	780 U	1400 J	1400 JD							
Fluoranthene	840 U	840 U	780 U	780 U	410 U	1800 U							
Pyrene	840 U	840 U	780 U	780 U	410 U	1800 U							
Butyl Benzyl Phthalate	840 U	840 U	780 U	780 U	410 U	1800 U							
3,3'-Dichlorobenzidine	1700 U	1700 U	1800 U	1800 U	810 U	3200 U							
Benzo(a)Anthracene	840 U	840 U	780 U	780 U	410 U	1800 U							
Chrysene	840 U	840 U	780 U	780 U	410 U	1800 U							
bis(2-Ethylhexyl)Phthalate	840 U	840 U	780 U	780 U	410 U	1800 U							
Di-n-Octyl Phthalate	840 U	840 U	780 U	780 U	410 U	1800 U							
Benzo(b)Fluoranthene	840 U	840 U	780 U	780 U	410 U	1800 U							
Benzo(k)Fluoranthene	840 U	840 U	780 U	780 U	410 U	1800 U							
Benzo(a)Pyrene	840 U	840 U	780 U	780 U	410 U	1800 U							
Indeno(1,2,3-cd)Pyrene	840 U	840 U	780 U	780 U	410 U	1800 U							
Dibenzo(a,h)Anthracene	840 U	840 U	780 U	780 U	410 U	1800 U							
Benzo(g,h,i)Perylene	840 U	840 U	780 U	780 U	410 U	1800 U							

TABLE 5-B  
SEMIVOLATILE ORGANIC ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL  
(page 2 of 2)

SEMIVOLATILE COMPOUND	SAMPLE LOCATION AND NUMBER CONCENTRATIONS IN ug/kg													
	SS 70 ECX 09	SS 70 ECX 09RE	SS 84 ECX 10	SS 84 ECX 10RE	SS 59 ECX 11	SS 59 ECX 11RE								
Phenol	11000	11000	790 U	790 U	5600 J	6100 D								
bis(2-Chloroethyl)Ether	840 U	840 U	790 U	790 U	370 J	1800 U								
2-Chlorophenol	840 U	840 U	790 U	790 U	410 UJ	1800 U								
1,3-Dichlorobenzene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
1,4-Dichlorobenzene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
Benzyl Alcohol	840 U	840 U	790 U	790 U	410 UJ	1800 U								
1,2-Dichlorobenzene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2-Methylphenol	1000	1000	790 U	790 U	2100 J	2000 D								
bis(2-Chloroisopropyl)Ether	840 U	840 U	790 U	790 U	410 UJ	1800 U								
4-Methylphenol	4500	4100	790 U	790 U	4700 J	4500 D								
N-Nitroso-Diisopropylamine	840 U	840 U	790 U	790 U	410 U	1800 U								
Hexachloroethane	840 U	840 U	790 U	790 U	410 U	1800 U								
Nitrobenzene	840 U	840 U	790 U	790 U	410 U	1800 U								
Isophorone	840 U	840 U	790 U	790 U	410 U	1800 U								
2-Nitrophenol	840 U	840 U	790 U	790 U	410 U	1800 U								
2,4-Dimethylphenol	840 U	840 U	790 U	790 U	2800 J	2200 D								
Benzoic Acid	4200 U	4200 U	3900 U	3900 U	2000 UJ	6100 U								
bis(2-Chloroethyl)Methane	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2,4-Dichlorophenol	840 U	840 U	790 U	790 U	410 UJ	1800 U								
1,2,4-Trichlorobenzene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
Naphthalene	840 U	840 U	1100	1100	19000 EJ	20000 D								
4-Chloroaniline	840 U	840 U	790 U	790 U	410 UJ	1800 U								
Hexachlorobutadiene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
4-Chloro-3-Methylphenol	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2-Methylnaphthalene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
Hexachlorocyclopentadiene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2,4,6-Trichlorophenol	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2,4,5-Trichlorophenol	4200 U	4200 U	3900 U	3900 U	2000 UJ	6100 U								
2-Chloronaphthalene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2-Nitroaniline	4200 U	4200 U	3900 U	3900 U	2000 UJ	6100 U								
Dimethylphthalate	840 U	840 U	790 U	790 U	410 UJ	1800 U								
Acenaphthylene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
2,6-Dinitrotoluene	840 U	840 U	790 U	790 U	410 UJ	1800 U								
3-Nitroaniline	4200 U	4200 U	3900 U	3900 U	2000 UJ	6100 U								

NOTE: RE equals Reanalysis  
DL equals Dilution

TABLE V - 1  
VOLATILE ORGANIC ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL

VOLATILE COMPOUND	SAMPLE LOCATION AND NUMBER CONCENTRATIONS IN ug/kg												
	PWSATE * ECX 04	SS 70 ECX 08	SS 84 ECX 10	SS 88 ECX 11									
Chloromethane	10 U	48 U	40 U	44 U									
Bromomethane	10 U	48 U	40 U	44 U									
Vinyl Chloride	10 U	48 U	40 U	44 U									
Chloroethane	10 U	48 U	40 U	44 U									
Methylene Chloride	5 U	68 B	33 B	31 B									
Acetone	10 U	820	87	44 U									
Carbon Dioxide	5 U	25 U	20 U	22 U									
1,1-Dichloroethene	5 U	25 U	20 U	22 U									
1,1-Dichloroethane	5 U	25 U	20 U	22 U									
1,2-Dichloroethene (total)	5 U	25 U	20 U	22 U									
Chloroform	5 U	25 U	20 U	22 U									
1,2-Dichloroethane	5 U	25 U	20 U	22 U									
2-Butanone	10 U	86	8 J	44 U									
1,1,1-Trichloroethane	5 U	25 U	20 U	22 U									
Carbon Tetrachloride	5 U	25 U	20 U	22 U									
Vinyl Acetate	10 U	48 U	40 U	44 U									
Bromodichloromethane	5 U	25 U	20 U	22 U									
1,2-Dichloropropene	5 U	25 U	20 U	22 U									
Cis-1,3-Dichloropropene	5 U	25 U	20 U	22 U									
Trichloroethene	5 U	25 U	20 U	22 U									
Dibromochloromethane	5 U	25 U	20 U	22 U									
1,1,2-Trichloroethene	5 U	25 U	20 U	22 U									
Benzene	5 U	800	210	88									
Trans-1,3-Dichloropropene	5 U	25 U	20 U	22 U									
Bromoform	5 U	25 U	20 U	22 U									
4-Methyl-2-Pentanone	10 U	48 U	40 U	44 U									
2-Hexanone	10 U	48 U	40 U	44 U									
Tetrachloroethene	5 U	25 U	20 U	22 U									
1,1,2,2-Tetrachloroethane	5 U	25 U	20 U	22 U									
Toluene	5 U	180	110	84									
Chlorobenzene	5 U	25 U	20 U	22 U									
Ethylbenzene	5 U	25 U	15 J	89									
Styrene	5 U	18 J	38	24									
Xylene (total)	5 U	25 U	64	81									

\* INDICATES WATER SAMPLE

TABLE P-1  
PESTICIDE ANALYSIS FOR SOIL  
OUTBOARD MARINE CORP.  
WAUKEGAN, IL

PESTICIDE	SAMPLE LOCATION AND NUMBER													
	CONCENTRATIONS IN ug/kg													
	SS 44-02 ECX 01	SS 44-03 ECX 02	SS 48-03 ECX 03	RINSTATE *ECX 04	SS 48-03 ECX 05	SS 48-03 ECX 06	SS 48-03 ECX 07	SS 48-03 ECX 07	SS 60-02 ECX 08	SS 70 ECX 09	SS 84 ECX 10	SS 89 ECX 11		
Alpha-BHC	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Beta-BHC	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Delta-BHC	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Lindane	32 U	10 U	10 U	0.05 U	10 U	10 U	32 U	30 U	41 U	10 U	20 U			
Heptachlor	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Aldrin	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Heptachlor Epoxide	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Endosulfan I	30 U	10 U	10 U	0.05 U	20 U	10 U	30 U	30 U	41 U	10 U	20 U			
Dieldrin	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
4,4'-DDE	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
Endrin	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
Endosulfan II	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
4,4'-DDD	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
Endosulfan Sulfate	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
4,4'-DDT	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
Methoxychlor	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Endrin Ketone	77 U	30 U	30 U	0.10 U	41 U	30 U	77 U	77 U	82 U	30 U	40 U			
Alpha-Chlordane	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Gamma-Chlordane	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Toxaphene	770 U	300 U	300 U	1.0 U	410 U	300 U	770 U	770 U	820 U	300 U	400 U			
Arochlor-1016	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Arochlor-1221	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Arochlor-1232	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Arochlor-1242	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Arochlor-1248	300 U	100 U	100 U	0.50 U	200 U	100 U	300 U	300 U	410 U	100 U	200 U			
Arochlor-1254	770 U	300 U	300 U	1.0 U	410 U	300 U	770 U	770 U	820 U	300 U	400 U			
Arochlor-1260	770 U	300 U	300 U	1.0 U	410 U	300 U	770 U	770 U	820 U	300 U	400 U			

TABLE 4-1  
TOTAL METALS AND CYANIDE ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL

METALS AND CYANIDE	SAMPLE LOCATION AND NUMBER CONCENTRATIONS IN mg/kg													
	SS 44-02 MECL 00	SS 48-03 MECL 01	SS 48-03 MECL 02	SS 48-03 MECL 03	SS 48-03 MECL 04	SS 60-02 MECL 06	SS 70 MECL 08	SS 84 MECL 07	SS 84 MECL 07D	SS 86 MECL 08				
Aluminum	1360	1860	1860	2830	2270	1610	4470	1660	1631	1400				
Antimony	22.6	18.8	18.3	23.8	19.7	16.4	18.7	18.0	17.8	17.8				
Arsenic	3.8	10.0	10.3	28.9	9.1	6.3	8.8	4.7	4.8	4.2				
Barium	6.2 B	6.9 B	4.8 B	9.7 B	8.2 B	6.7 B	8.7 B	6.3 B	6.1 B	6.2 B				
Beryllium	0.12 B	0.11 B	0.14 B	0.16 B	0.17 B	0.09 B	0.16 B	0.16 B	0.12 B	0.12 B				
Cadmium	0.34 U	0.38 U	0.38 U	0.31 U	0.38 U	0.36 U	0.40 U	0.38 U	0.37 U	0.38 U				
Calcium	78100	76000	72900	84200	78100	68600	70600	67800	68000	87600				
Chromium	3.9	3.9	4.0	6.2	4.7	6.8	6.0	7.0	6.3	6.4				
Cobalt	4.2 U	4.7 U	4.4 U	6.1 B	7.9 B	10.8	8.2 B	7.8 B	11.6	4.8 U				
Copper	33.8	1420	112	1480	196	29.0	488	66.6	83.7	367				
Iron	4460	4170	4130	16100	4890	5890	5800	8180	7222	6630				
Lead	2.3	2.8	3.1	4.4	3.8	2.7	4.1	2.9	2.8	2.4				
Magnesium	41300	37800	34300	63200	34900	28900	33800	28000	28100	34700				
Manganese	188	188	204	440	217	184	224	182	189	183				
Mercury	0.12 U	0.10 U	0.10 U	0.11 U	0.09 U	0.08 U	0.08 U	0.08 U	0.11 U	0.10 U				
Nickel	2.4 B	2.8 B	3.7 B	11.7	3.9 B	3.2 B	3.7 B	3.7 B	4.1 B	3.6 B				
Potassium	131 U	274 B	221 B	368 B	384 B	188 B	372 B	217 B	200 B	181 B				
Selenium	0.38 B	0.24 U	0.26 U	0.80 B	0.88 B	0.66 B	1.8	1.2	1.1 B	0.37 B				
Silver	0.46 U	0.62 U	0.48 U	0.42 U	0.62 U	0.47 U	0.64 U	0.62 U	0.61 U	0.62 U				
Sodium	202 B	248 B	264 B	288 B	246 B	201 B	221 B	216 B	180 B	208 B				
Thallium	0.24 U	0.24 U	0.26 U	0.12 B	0.24 U	0.24 U	0.28 B	0.09 B	0.14 B	0.24 B				
Vanadium	13.8	6.2 B	6.6 B	6.9 B	6.9 B	21.8	10.4 B	38.4	28.7	22.1				
Zinc	31.8	628	74.9	406	162	28.4	236	44.8	67.7	160				
Cyanide	0.88 U	0.80 U	0.87 U	0.64 U	0.71 U	0.71 U	0.88 U	0.87 U	0.87 U	0.88 U				

NOTE: D equals Duplicate

TABLE S-1  
SEMIVOLATILE ORGANIC ANALYSIS FOR SOIL  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, IL  
(page 1 of 2)

SEMIVOLATILE COMPOUND	SAMPLE LOCATION AND NUMBER													
	CONCENTRATIONS IN ug/kg													
	SS 44-02 ECX 01	SS 44-03 ECX 02	SS 44-03 ECX 02RE	SS 49-03 ECX 03	SS 49-03 ECX 03RE	RINSATE "ECX 04	SS 48-03 ECX 05	SS 48-03 ECX 05RE	SS 46-03 ECX 06	SS 46-03 ECX 06RE	SS 46-03 ECX 07	SS 46-03 ECX 07RE	SS 60-02 ECX 08	
Acenaphthene	800 U	780 U	47000 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	2300 U	
2,4-Dinitrophenol	4000 U	3800 U	8400 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
4-Nitrophenol	4000 U	3800 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
Dibenzofuran	800 U	780 U	47000 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	2100 U	
2,4-Dinitrotoluene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Diethylphthalate	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
4-Chlorophenyl Phenyl Ether	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Fluorene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	2200 U	
4-Nitroaniline	4000 U	3800 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
4,6-Dinitro-2-Methylphenol	4000 U	3800 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
N-Nitrosodiphenylamine(1)	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
4-Bromophenyl Phenyl Ether	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Hexachlorobenzene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Pentachlorophenol	4000 U	3800 U	47000 U	4000 U	48000 U	50 U	4100 U	21000 U	4000 U	20000 U	4000 U	72000 U	4000 U	
Phenanthrene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	2800 U	
Anthracene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Di-n-Butylphthalate	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Fluoranthene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Pyrene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Butyl Benzyl Phthalate	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
3,3'-Dichlorobenzidine	1800 U	1800 U	18000 U	1800 U	18000 U	20 U	1700 U	8300 U	1800 U	8000 U	1800 U	20000 U	1800 U	
Benzo(a)Anthracene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Chrysene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Me(2-Ethylhexyl)Phthalate	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Di-n-Octyl Phthalate	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Benzo(b)Fluoranthene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Benzo(k)Fluoranthene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Benzo(a)Pyrene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Indeno(1,2,3-cd)Pyrene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Dibenzo(a,h)Anthracene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	
Benzo(g,h,i)Perylene	800 U	780 U	8400 U	800 U	9700 U	10 U	830 U	4100 U	800 U	4000 U	800 U	14000 U	800 U	

*1990/1991 Investigation*

## RESULTS.XLS

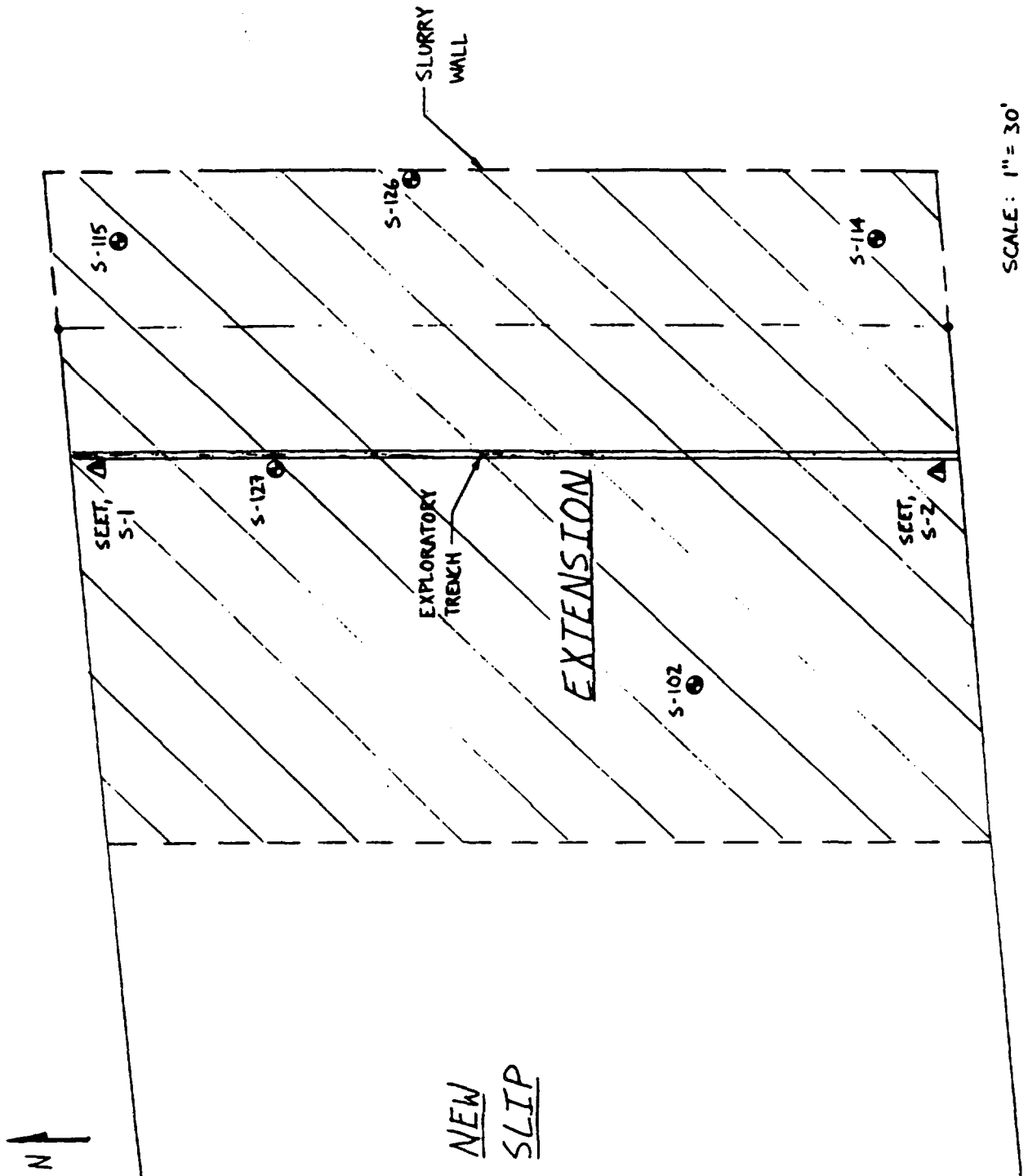
BORING	S-102	S-102	S-102	S-102	S-114	S-114	S-114
SAMPLE	S-1	S-2	S-3	S-3DL	S-1	S-1MS	S-1MSD
DEPTH	5.0'-7.0'	15.0'-17.0'	24.0'-26.0'	24.0'-26.0'	5.0'-7.0'	5.0'-7.0'	5.0'-7.0'
TOTAL PHENOLS	0.00	0.46	82.00	122.10	0.00	0.00	0.00
TOTAL NON-CARC. PNAs	1.21	0.05	0.36	0.00	11.50	6.39	7.04
TOTAL CARCINOGENIC PNAs	0.00	0.00	0.00	0.00	2.14	0.73	1.52
TOTAL PNAs	1.21	0.05	0.36	0.00	13.64	7.12	8.56
BORING	S-114	S-114	S-114	S-115	S-115	S-115	S-115
SAMPLE	S-2	S-3	S-3DL	S-1	S-2	S-3	S-3DL
DEPTH	15.0'-17.0'	25.0'-27.0'	25.0'-27.0'	5.0'-7.0'	15.0'-17.0'	25.0'-27.0'	25.0'-27.0'
TOTAL PHENOLS	0.00	18.80	23.80	0.00	0.00	33.60	52.90
TOTAL NON-CARC. PNAs	0.72	0.05	0.00	0.00	0.58	0.06	0.00
TOTAL CARCINOGENIC PNAs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL PNAs	0.72	0.05	0.00	0.00	0.58	0.06	0.00
BORING	S-126	S-127	S-127	S-127	SEET	SEET	
SAMPLE	S-1	S-1	S-2	S-3	S-1	S-2	
DEPTH	5.0'-6.5'	5.0'-6.5'	15.0'-16.5'	25.0'-26.5'	4.0'	4.0'	
TOTAL PHENOLS	0.00	1.61	0.00	89.10	0.00	0.00	
TOTAL NON-CARC. PNAs	0.61	1.34	0.05	0.00	1.32	0.27	
TOTAL CARCINOGENIC PNAs	0.00	0.00	0.00	0.00	2.26	0.30	
TOTAL PNAs	0.61	1.34	0.05	0.00	3.58	0.57	

# Canonie

By \_\_\_\_\_ Date \_\_\_\_\_ Subject \_\_\_\_\_ Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Chkd. By \_\_\_\_\_ Date \_\_\_\_\_ Proj. No. \_\_\_\_\_

1/4" X 1/4"



BORING	S-52	S-52	S-55	S-55	S-118	S-118	S-118
SAMPLE	S-2	S-3	S-2	S-3	S-1	S-10L	S-2
DEPTH	15.0'-17.0'	24.0'-26.0'	15.0'-17.0'	24.0'-26.0'	6.0'-8.0'	6.0'-8.0'	8.0'-10.0'
TOTAL PHENOLS	25.80	66.20	2.01	157.30	0.00	0.00	0.00
TOTAL NON-CARC. PNAs	27.00	0.00	6.17	15.00	21.52	18.71	11.85
TOTAL CARCINOGENIC PNAs	0.00	0.00	0.00	0.00	0.05	0.00	0.00
TOTAL PNAs	27.00	0.00	6.17	15.00	21.57	18.71	11.85

BORING	S-118	S-119	S-119	S-119	S-119	S-119	S-119
SAMPLE	S-3	S-1	S-10L	S-2	S-20L	S-3	S-30L
DEPTH	10.0'-12.0'	6.0'-8.0'	6.0'-8.0'	8.0'-10.0'	8.0'-10.0'	10.0'-12.0'	10.0'-12.0'
TOTAL PHENOLS	0.00	0.05	0.00	0.00	0.00	0.00	0.00
TOTAL NON-CARC. PNAs	8.50	35.03	28.47	40.81	40.18	140.76	207.70
TOTAL CARCINOGENIC PNAs	0.00	4.85	4.65	6.32	6.34	82.10	77.10
TOTAL PNAs	8.50	39.88	33.12	47.13	46.52	222.86	284.80

BORING	S-132	S-132	S-133	S-133	S-133	S-133	S-133
SAMPLE	S-1	S-10L	S-1	S-10L	S-2	S-20L	S-3
DEPTH	18.0'-20.0'	18.0'-20.0'	18.0'-20.0'	18.0'-20.0'	21.0'-23.0'	21.0'-23.0'	24.0'-26.0'
TOTAL PHENOLS	72.40	70.30	21.10	20.00	62.80	37.70	59.50
TOTAL NON-CARC. PNAs	0.92	0.78	1022.20	880.00	314.00	339.90	170.90
TOTAL CARCINOGENIC PNAs	0.00	0.00	164.92	85.90	108.00	62.30	18.40
TOTAL PNAs	0.92	0.78	1187.12	965.90	422.00	402.20	189.30

BORING	S-134	S-134	S-135	S-135	S-136	S-136	S-136
SAMPLE	S-1	S-10L	S-1	S-10L	S-1	S-10L	S-2
DEPTH	18.0'-20.0'	18.0'-20.0'	18.0'-20.0'	18.0'-20.0'	5.0'-7.0'	5.0'-7.0'	7.0'-9.0'
TOTAL PHENOLS	16.84	13.81	93.10	168.10	0.00	0.00	0.00
TOTAL NON-CARC. PNAs	43.69	40.50	2.77	3.50	1018.90	937.10	3.14
TOTAL CARCINOGENIC PNAs	7.89	6.39	0.00	0.00	309.80	420.00	0.24
TOTAL PNAs	51.58	46.89	2.77	3.50	1328.70	1357.10	3.38

BORING	S-137
SAMPLE	S-1
DEPTH	5.0'-7.0'
TOTAL PHENOLS	0.00
TOTAL NON-CARC. PNAs	4.93
TOTAL CARCINOGENIC PNAs	0.33
TOTAL PNAs	5.26

## C

**1/4" X 1/4"**

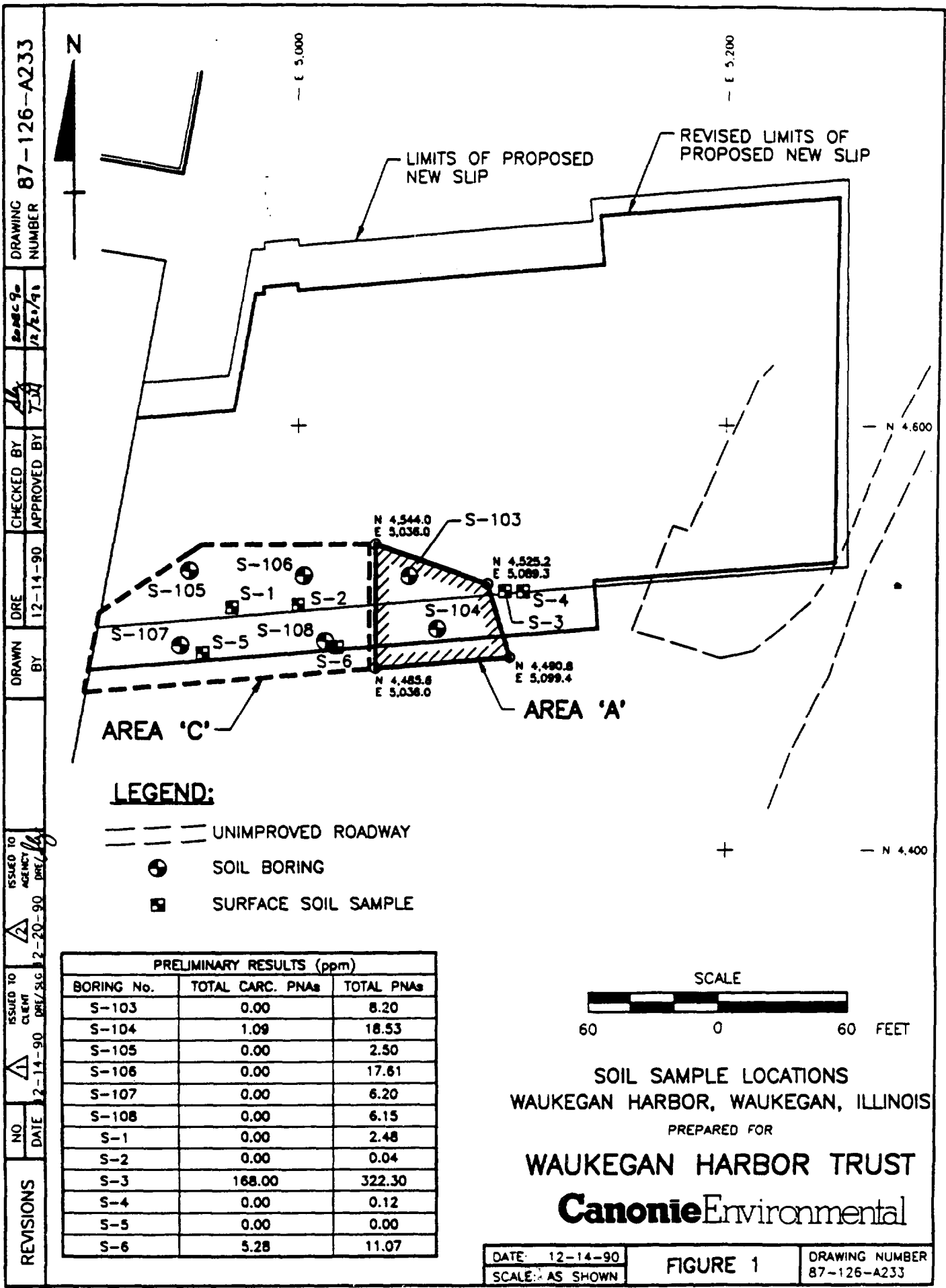


----- ORIGINAL AREA A BOUNDARIES

From Dec. 90  
Status Report

Table 1  
Preliminary Soil Sampling Results  
New Slip Boring Program

Boring Number	S-103	S-104	S-105	S-106	S-107	S-108	NSWT	NSWT	NSWT	NSWT	NSWT	NSWT
Canonie I.D. No.	S - A1	S - A1	S - A1	S - A1	S - A1	S - A1	S - 1	S - 2	S - 3	S - 4	S - 5	S - 6
CompuChem I.D. No.	383097	383080	383763	383383	383758	383388	86708	86709	86713	86714	87954	87955
Sample Depth (feet):	9.0 - 11.0	11.0 - 13.0	9.0 - 11.0	11.0 - 13.0	9.0 - 11.0	9.0 - 11.0	5	5	2.5	2.5	5	4
Chemical Name												
Benzole Acid								0.038				
Naphthalene	4.1	.92	.14	10	1.7	3.3			3.5			.12
2-Methylnaphthalene	0.099	.11		4.2		1.3			2			0.077
Acenaphthylene		0.067	.06	.13					2.7			.15
Acenaphthene	1.5	3.6	.68	1.5	2.6	1.2	1.5		1.6	.06		.13
Dibenzofuran	.43	2	1	.86	1.4	0.063			1.8			0.095
Fluorene	.63	2.7	.62	.92	.5	.23		.92	1.2			0.088
Phenanthrene	1.4	4.8					0.059		15			.54
Anthracene	0.041	.64							3.8			.26
Fluoranthene		1.5							62			2.5
Pyrene		1.1							51	0.058		1.5
Benzo(a)anthracene **		.43							26			.9
Bis (2-ethylhexyl) phthalate						0.055						
Chrysene **		.5							29			.72
Benzo(b)fluoranthene **		0.059							42			1.3
Benzo(k)fluoranthene **		0.059							42			1.3
Benzo(a)pyrene **		0.043							17			.63
Indeno (1,2,3-c,d)pyrene **									9			.32
Dibenzo (a,h) anthracene **									3			.11
Benzo (g,h,i) perylene									9.7			.33
Total Non-carcinogenic PNAs	8.20	17.44	2.50	17.61	6.20	6.15	2.48	0.04	183.30	0.12	0.00	5.79
Total Carcinogenic PNAs	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00	168.00	0.00	0.00	5.28
Total PNAs	8.20	18.53	2.50	17.61	6.20	6.15	2.48	0.04	322.30	0.12	0.00	11.07
Typical Detection Limit	0.40	0.40	0.40	0.40	0.40	0.40	0.33	0.33	3.30	0.33	0.00	0.37



DRAWING NUMBER 87-126-A233

20/08/90 12/5/91

CHECKED BY [Signature] APPROVED BY [Signature]

DRE 12-14-90

DRAWN BY [Signature]

ISSUED TO CLIENT 12-14-90

ISSUED TO AGENCY 12-20-90

NO. DATE

REVISIONS

DATE: 12-14-90

SCALE: AS SHOWN

FIGURE 1

DRAWING NUMBER 87-126-A233

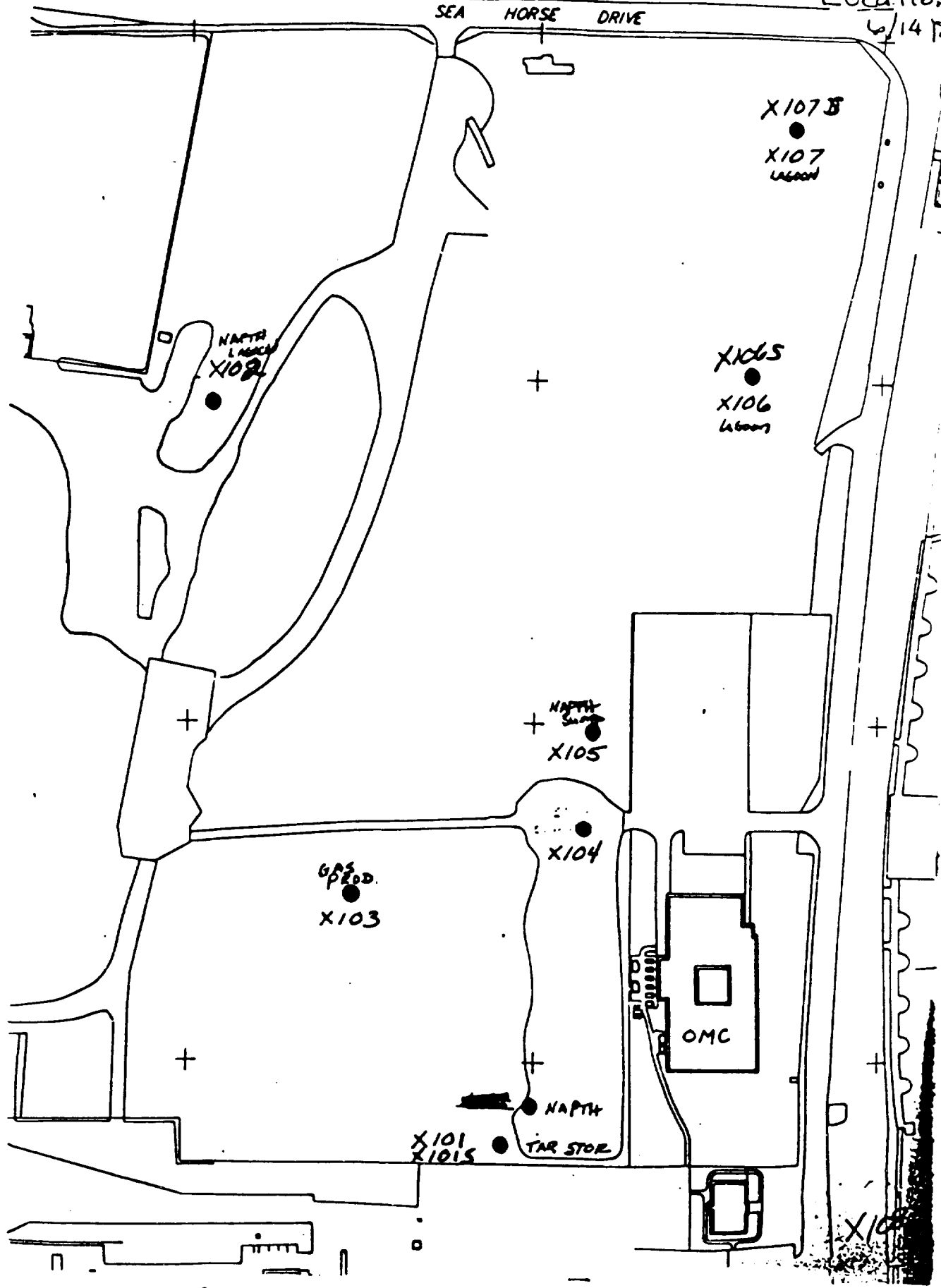
***Appendix C***

***IEPA Investigation  
Soil Quality Data***



# GM COKE PLANT SUPERFUND/HRS Sample Location

SEA HORSE DRIVE 6/14/82



PROPOSED SOIL SAMPLE LOCATIONS

PUT SITE NAME HERE 6-22 CONE ROAD  
PUT USDA NUMBER HERE ALD 980995570

TABLE 4-1  
SUMMARY

SAMPLING POINT	X101 4'-5'	X101.5 5'-6'	X102 6'-7'	X102.5 7'-8'	X103 8'-9'	X104 9'-10'	X104.5 10'-11'	X105 11'-12'	X105.5 12'-13'	X106 13'-14'	X106.5 14'-15'	X107 15'-16'
Volatiles (ppb)	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81	6-14-81
Chloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Bromoethane	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethene	-	-	-	-	-	-	-	-	-	-	-	-
Nitroethene Chloride	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulfide	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane (total)	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone (MEK)	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Acetate	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloroethane	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Bichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloroethane	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Bromoacetylene	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-Bichloropropene	-	-	-	-	-	-	-	-	-	-	-	-
Bromopropene	-	-	-	-	-	-	-	-	-	-	-	-
4-Vinyl-2-Pentene	-	-	-	-	-	-	-	-	-	-	-	-
2-Nonene	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Isobutene	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-
Xylene (total)	-	-	-	-	-	-	-	-	-	-	-	-

SUMMARY VALUES (ppb)

Pinene  
In (2-Dichloroethane) other

[illegible]



NOT SITE NAME HERE  
AND USERN NAME OR NUMBER

**TABLE 4-1**  
**Summary**

**Summary**

**2021.11.16 P.011**

6-44-57  
XEROX

12-17-77

11

2-Dialap hool

**1. Technical specifications**

[illegible]

**1,2-Dichloroethane**

2-Methyl-1-propanol

Hispanic population

**1. Introduction**

## Method and Materials

**Waltersburg, Ohio**

11/11/11

## 2.4 Direct hypothesis

**Brookfield**

biochemical methods

1.2.4-1r1 different

— 1960

## 1-Click on online

## Medical or dental license

## 2-Fluorobenzaldehyde

Health or safety regulations

2,4,6-trichlorophenol]

2-DNA or with one

2-Methyl-2-butanol

## Decorating Up Home Lanes

26th June 1944

**3-4 (over) line**

**Deputy Clerk**

2,4-Dinitrophenol

**www.legis.wa.gov**  
**legis.wa.gov**

2,4-Dialdehyde

Druckjahr 1944

4-Unit upheng | pho  
 4-Unit upheng | pho

4-36450-0000

450mire-2-Mch





PUT SJT NAME HERE  
PUT USER NUMBER HERE

**ADVERTS**  
**1-7 FREE**

[illegible]



FROM 217 785 3846

PAGE 10

- U - Indicates compound was analyzed for but not detected.
- J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.
- C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.
- B - This flag is used when the analyte is found in the associated blank as well as in the sample.
- E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticide/PCB's analyzed by GC/EC methods.
- D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.
- A - This flag indicates that a TIC is a suspected aldol-condensation product.
- X - Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the Sample Data Summary Package and the Case Narrative.

## INORGANIC DATA QUALIFIERS

### C (Concentration) Qualifier:

- B - Indicates the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL).
- U - Indicates compound was analyzed for but not detected.

### Q Qualifier:

- E - The reported value is estimated because of the presence of interference.
- M - Duplicate injection precision not met.
- N - Spiked sample recovery not within control limits.
- S - The reported value was determined by the Method of Standard Additions (MSA).
- W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while the sample absorbance is less than 50% of spike absorbance.
- \* - Duplicate analysis not within control limits.
- + - Correlation coefficient for the MSA is less than 0.995.

### M (Method) Qualifier Enter:

- "P" for ICP
- "A" for Flame AA
- "F" for Furnace AA
- "CV" for Manual Cold Vapor AA
- "AV" for Automated Cold Vapor AA
- "AS" for Semi-Automated Spectrophotometric
- "C" for Manual Spectrophotometric
- "T" for Titrimetric
- "NR" if the analyte is not required to be analyzed.